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Journal of the Society of Arts.

FRIDAY, FEBRUARY 13, 1863.

NOTICE TO INSTITUTIONS AND LOCAL BOARDS.

Copies of a speech delivered by Mr. Harry Chester, Vice-President of the Society of Arts, and Chairman of the Committee of the Metropolitan Association for Promoting the Education of Adults, entitled "Education and Advancement for the Working Classes," as well as of a memoir by Professor Leone Levi, F.S.A., F.S.S., "On the Metric System of Weights and Measures," with a circular on the same subject, have been forwarded to each Institution and Local Board.

SOCIETY'S MEMORIAL OF THE PRINCE CONSORT.

A General Meeting of the members of the Society was held on Saturday, the 7th inst., to receive a report from the Council in reference to the intended memorial of the Prince Consort for the Society.

Sir THOMAS PHILLIPS, F.G.S., Chairman of the Council, presided.

The SECRETARY read the notice convening the meeting and also the following

REPORT OF THE COUNCIL.

At a general meeting of the Society, specially convened, held on the 21st of March, 1862, the following resolution was passed unanimously:—

"That, cordially approving of the address of condolence presented by the Council to the Queen, and also of the vote of 1,000 guineas from the funds of the Society to the National Memorial, the members of the Society of Arts, in this general meeting assembled, are anxious further to record their deep sense of the irreparable loss which the Society, in common with the Queen and nation, has sustained by the most afflicting dispensation which has deprived it of its illustrious President, the Prince Consort; and this Society, being under peculiar obligations to His Royal Highness, whose zealous devotion to its interests was unceasing during the 18 years of his enlightened presidency, the members desire to testify their estimation of his great services and high qualities, by having a special memorial for the Society, and that the Council be requested to consider the most appropriate form of the memorial, and bring the matter before a meeting of the members at a fitting time."

The Council have had the foregoing resolution under their consideration, and they recommend that the memorial consist of a bust of his Royal Highness in marble, to be placed in a suitable manner in the great room of the Society, and that the funds be raised by subscription amongst the members, and that any surplus funds not required for that object be applied in such manner as the subscribers may direct; and the Council are of opinion that a gold medal, to be called the Albert medal, should be provided by the Society, to be awarded by the Council, not oftener than once a year, "for distinguished merit in promoting Arts, Manufactures, or Commerce."

The Right Hon. Sir JOHN PAKINGTON, Bart., G.C.B., M.P., said, having had the privilege of moving the resolution at the former meeting, on which the Council had made their

report which had just been read, he might be allowed to move the adoption of the report. He had no hesitation in saying that, in his opinion, the recommendation of the Council—that they should erect in that room a bust of His Royal Highness—was the best that could have been made. That was the idea that was in his mind at the first meeting, when he moved the resolution; and he was disposed to hope, notwithstanding the fact that this Society in its corporate capacity had made a splendid donation to the National Memorial—that it would be gratifying to the feelings of every member to see a bust of His Royal Highness in that room as a tribute of respect to his memory on the part of this Society. With regard to matters of detail—whether the expense be defrayed by the subscriptions of individual members, or by a grant from the funds of the Society, was a matter which he should be content to leave to the general feeling of the meeting, though, for his part, he was desirous to move that the report of the Council be adopted.

Mr. J. H. MURCHISON said, having personally taken an active part in the movement of last year to obtain a memorial of the Prince Consort for the Society, he trusted he might be permitted to second the motion for the adoption of the report; and he was glad that, although occasionally he had found it necessary to find fault with the proceedings of the Council, on the present occasion, at all events, nothing should fall from him which should cause serious difference of opinion, or give rise to anything which should lead to unpleasant discussion. Last year when this question was brought before the Society, it was objected that it was premature. He was not now about to make any comment upon the wisdom or otherwise of postponing this measure, but he was glad to find that every suggestion which he then made had been adopted by the Council. The charter of this Society stated its objects to be "For the Encouragement of Arts, Manufactures, and Commerce, by bestowing rewards for such productions, inventions, or improvements, as should tend to the employment of the poor, to the increase of trade, and to the riches and honour of the kingdom." When the late Prince Consort became President of this Society, he (Mr. Murchison) recollected that his Royal Highness expressed himself highly gratified at being called to preside over a society having objects of so laudable a character, and the Prince showed the appreciation which he entertained of the mode in which this Society had promoted its great objects, by advising, soon after his election as president, a large increase in the premiums offered for inventions and improvements in arts and science. Two years after his election, the Prince himself offered a medal for the best essay on "The Cultivation and Manufacture of Sugar;" and he was sure those members of the Society who were present at the opening meeting of the session, must have been highly delighted at seeing the chairman present a prize of twenty-five guineas, given by the Prince Consort himself, in connection with the educational examinations carried on by this Society. Now, if they referred to the mode in which other institutions endeavoured to promote their objects; if they looked to Cambridge, they found that medals were offered to encourage various branches of knowledge, and they found there one given by the Prince Consort himself, as chancellor of the university. That being the case, he thought, although a bust was an appropriate method of keeping alive the memory of the Prince, yet, to perpetuate the great objects which his Royal Highness promoted when living, the founding an Albert Medal was a recommendation which was deserving of their strongest approval and support. This Society, he believed, since its foundation, had awarded no fewer than 20,000 premiums for the promotion of the arts and sciences, and if, in future, they had a medal to be denominated the Albert Medal, it would be as greatly coveted as the Copley medal of the Royal Society. That was a medal which was open to men in all branches of science, and of all nations. He did not presume to indicate in what direction the Albert medal

should be used to promote the objects of the Society, but he had consulted a great number of the members of this Society, and had received letters from some of them, indicating their views on the subject. He would only refer to one which he had received from Lord Radstock, in which his lordship, after expressing his approval of the foundation of the Albert gold medal, suggested that it should be given for the greatest practical improvement in the cheapening of articles tending to promote the comfort and health of the labouring classes, and for improvements in the construction and fittings of their dwellings. He thought, with regard to the bust, it ought certainly to be provided by the individual subscriptions of the members, as the Council had recommended, but with regard to the medal, he hoped, inasmuch as the funds of this Society had so greatly increased under the presidency of the Prince Consort, the medal would be provided from that source.

The CHAIRMAN said that was the recommendation of the Council.

Mr. MURCHISON was very glad to hear it was so; and he was quite sure it would meet with the unanimous approval of the meeting. He begged to second the adoption of the report.

Mr. J. SCOTT RUSSELL, F.R.S., said, before the resolution was put, he would suggest the alteration of the word "bust." A bust, as generally understood, meant a rather insignificant and common-place work of art—perhaps more insignificant and more common-place than the Council intended. If a little latitude were allowed, and the work of art were not called a bust, he should prefer it.

Mr. GEORGE GODWIN, F.R.S., suggested the use of the words "sculptured memorial." He trusted that, whatever might be the result with regard to this question, the artistic element would not be lost sight of in the proposed Albert Medal, inasmuch as that was a branch of art in which they were at present very deficient, from the very little encouragement that was given it; and he believed, from the movement of the Society in this direction, and the steps they would take to obtain a fitting medal, much good would result.

Mr. FREDERIC LAWRENCE said he could not agree with the two last speakers. He thought the Council had very properly worded their report. He thought a good bust was better than a bad statue. He hoped the decision of the meeting would be in favour of a bust, which they might all admire, as the result of a competition amongst the artists of the day. He should like the sculptors to have an opportunity of exhibiting models of the bust they proposed to supply—not that one gentleman should be selected to execute it without any competition. With regard to the Albert Medal, he thought everyone in the room must heartily approve of that recommendation of the Council. At the same time he could not agree with Lord Radstock, who proposed to restrict the appropriation of that medal to purposes of a very limited character; and whilst he thought it ought not to be restricted to such purposes as those indicated, he would on his own behalf express a hope that the medal would not be appropriated to the educational department of the Society, but that it would be devoted to the main objects of the Society, namely—the promoting of Arts, Manufactures, and Commerce. He hoped it would be a valuable medal—one worth striving for—not a small mark of honour, but one which all might be proud to obtain.

After some remarks by Mr. DUTTON, Mr. P. PALMER, and other members,

Mr. UNDERDOWN rose to support the resolution—that the recommendation of the Council be adopted in the matter of the bust. He agreed with them that that would be the best form of memorial. He had before his mind's eye two or three statues of His Royal Highness, the multiplication of which he did not think would tend either to promote the reputation of the Society of Arts, or add to the fame of our sculptors. He did not agree with the gentleman (Mr. Lawrence) who had suggested compe-

titition for the design of the bust. He thought the system of competition in art was bad, and had this serious drawback—that the better class of artists would not compete.

Mr. W. H. BODKIN said it must be satisfactory to the Council to find that on this question there was no substantial difference of opinion in the meeting. They were all anxious to do, in the best way in their power, honour to the memory of the late Prince. He would take the liberty of saying, having served on the committee of Council to whom this question was referred, that they had most anxiously considered it in every point of view, and after due deliberation they arrived at the conclusion that it would be better to recommend a bust; but it would be found that the wording of the report was such as to admit of any accessories to the bust which the means at command might enable them to supply, so that the report might be adopted in its present form, with the expression as it there stood, "to be placed in a suitable manner in the Great Room of this Society." He thought those words gave ample latitude to the Council to add any accessorial sculpture, or other adornment coming within the means at their disposal.

Mr. SCOTT RUSSELL said if the term "bust" was to be taken in the large significance expressed by the hon. and learned gentleman, his objection was entirely removed.

Sir JOHN PAKINGTON wished, before the question was put, to explain a misapprehension under which he laboured when he first addressed the meeting. He admitted it was his own mistake entirely, but from the form in which the report was drawn, he was under the impression that the first clause of the report only, viz., that referring to the marble memorial, was embraced in the resolution now before the meeting, and on that account he had made no allusion to the second, and, as he regarded it, more important recommendation for the foundation of an annual gold medal, to be called the Albert Medal. He thought it most fitting and most appropriate to the great objects of this Society, of which he most cordially approved, and he hoped it would be carried out. He should have been sorry that the question should have been put without this explanation. As he had risen to make this explanation, he might advert to what had fallen from his friend Mr. Scott Russell, with regard to the first of these recommendations, viz., the bust. He did not agree with that gentleman in his remarks, depreciating, as he thought, unduly busts as works of art. They must all have in their minds many instances in which marble busts were very splendid works of art, and he thought it would not be desirable that any expression of opinion should go forth from this Society to undervalue the importance of such productions. But having said this, on the other hand, he really felt very little choice in his own mind whether they placed in that room a bust or a statue of his Royal Highness. Both, according to the merits of the sculptor, might be, and often were, splendid works of art. He thought the difficulty might be met and the matter left open by the addition of the words either "sculptured memorial," or "portrait in sculpture."

After some remarks from Mr. W. HAWES, Mr. S. REDGRAVE, Mr. ATKINSON, Mr. THOMAS WINKWORTH, Mr. J. H. MURCHISON, Sir JOHN PAKINGTON, and other members,

Mr. BODKIN suggested that the resolution should be passed as it stood, and if hereafter it should be found expedient to depart from it and to extend their design, the Council could report to that effect to a future meeting. His object in offering this suggestion was to promote unanimity.

The resolution, that the report be received and adopted, was then carried unanimously.

Mr. BODKIN then proposed the following resolution:—

"That it shall be hereafter considered expedient to depart from the original proposition for a bust. The Council do report any new proposal which they desire to recommend to a meeting of the members."

The resolution, having been seconded by Mr. DUTTON, was unanimously agreed to.

It was then moved and seconded,

"That the subscriptions be confined to members of the Society, and that each subscription be limited to one guinea."

This resolution having been unanimously passed,

Sir JOHN PAKINGTON proposed a vote of thanks to Sir Thomas Phillips for presiding over the meeting, which was seconded by Mr. SCOTT RUSSELL, and carried unanimously.

TENTH ORDINARY MEETING.

WEDNESDAY, FEBRUARY 11, 1863.

The Tenth Ordinary Meeting of the One Hundred and Ninth Session was held on Wednesday, the 11th inst., William Hawes, Esq., Vice-President of the Society, in the chair.

The following candidates were proposed for election as members of the Society :—

Bright, Sir Charles	{ 1, Victoria-street, Westminster, S.W.
Clark, Latimer	{ 1, Victoria-street, Westminster, S.W.
Corss, James	{ 63, Shoreditch High-street, N.E.
Deane, Edward	{ 1, Arthur-street East, London-bridge, E.C.
Figg, John Wilmin	{ 1, Denmark-street, Soho, W.C.
Pierce, Charles	{ Boadices, Balham.
Pim, Captain Bedford, R.N.....	{ Junior United Service Club, S.W.
Seager, General Edward...	{ 9, St. James's-street, S.W.
Shallis, John	{ 11, St. Mark's-square, N.W.

AND AS HONORARY CORRESPONDING MEMBER.

Maurice, G.....	{ Secretary of the Société d'Encouragement, 44, Rue Bonaparte, Paris.
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The following Candidates were balloted for and duly elected members of the Society :—

Adley, Charles Coles.....	{ 49, Hereford-road North, N.
Beaumont, Joseph	{ 22, Parliament-street, S.W.
Mackenzie, John Henry...	{ 3, Dr. Johnson's-buildings, Temple, E.C.
Willans, John Wrigley...	{ 3, Bishopsgate-street Within, E.C.

The CHAIRMAN said the reason why he appeared before them as Chairman was that Mr. Grove, who was to have presided, had, at the last moment, sent a message to the Secretary stating that, having been five days in court in a heavy cause, he was so fatigued that he could not undertake the duties of Chairman this evening. He (Mr. Hawes) had, therefore, been asked to preside over the meeting.

The Paper read was—

ON SUBMARINE TELEGRAPHY.

By THOMAS WEBSTER, M.A., F.R.S.

The responsibility of bringing this subject forward this evening having unexpectedly devolved upon me, I beg to tender my thanks to the Council for so promptly responding to the suggestion that the discussion on the subject of submarine telegraphy should be resumed. This room appears peculiarly fitted for a subject involving so many questions of physical science, practical knowledge, and commercial enterprise, questions which, taken in the

aggregate, are beyond the scope of any of the many admirable societies of which this Society was the parent; and those who are acquainted with the way in which the Society has promoted and fostered the arts, will feel how fitting is the great social question of submarine telegraphy for the exercise and concentration of its energy and influence.

The paper of Mr. Masey has gone far to exhaust the history of the subject. On the present occasion it is proposed to direct attention to some practical considerations which lie at the basis of the successful solution of Atlantic telegraphy, as it would be matter of deep regret that another failure should take place, or even that another attempt should be made, until every precaution, suggested by past and present experience, should be taken to ensure the success of this noble enterprise. It would ill become us to disregard the warning conveyed in the concluding paragraph of the Report of the Commissioners, "that the failure of the existing submarine lines is due to causes which might have been guarded against had adequate preliminary investigation been made into the question."

This subject naturally resolves itself into the questions of the route, the cable, and the means of submersion.

Public attention has been directed to three routes across the Atlantic—the Central, the Northern, and the Southern, each presenting peculiar advantages and difficulties. The Central Atlantic, or the route from the West Coast of Ireland to Newfoundland, a distance of 1,700 geographical miles, was that to which attention was directed in 1856, as presenting a submarine plateau in the nature of a gently levelled plain, of a depth inaccessible to the anchors of vessels, and yet not so far depressed as to present serious difficulties in the submersion of the cable. The surface of the bottom of the ocean on the proposed route is said to be a portion of a great zone of table land, smoothly strewn with a deposit of shells as the sand of the sea-shore in a tranquil bay.

The history of the Atlantic cable laid on this route must ever be regarded with the deepest interest. That the cable should have been submerged and safely deposited on the bottom of the ocean, and have spoken at all, was a triumph of skill amounting almost to a miracle.

Since that great experiment much precise information has been attained as to the working, and the speed attainable in circuits of great length. It appears to have been ascertained that the rate of working a number of signals transmissible through two lines identical in every respect except as to length, is inversely as the square of the ratio of the lengths, that is to say, the speed of transmission, or number of words passed through a cable 600 miles in length, would be nine times as great as through a cable of 1,800 miles. This, which depends on a physical law of nature, is wholly independent of artificial and external conditions, as the insulation, which, however perfect, cannot affect the comparative results, and the shorter must always have a commercial advantage over the longer cable, which must necessarily influence the selection of routes. These and other considerations have called attention to two other routes for the Atlantic telegraph cable; one, the northern, from the west coast of Scotland, by the Faroe Islands, Iceland, and Greenland, to the east coast of Labrador, and the southern from the south coast of England, by the Canary and Cape Verd Islands to St. Paul, a small island in the South Atlantic Ocean, and thence by the Island of San Fernando to Brazil, and so along the coast of British Guiana and the West India Islands to America.

Both these routes present a convenient mode of dividing the distance into a series of short and manageable circuits, as in the case of the Government cable between Malta and Alexandria, which is divided into three, by the establishment of intermediate stations at Bengazi and Tripoli, and the cable in course of construction to connect India with Europe by way of the Persian Gulf. One main object of such division into separate circuits, is to ensure a high

speed of transmission, and one which may yield a profitable return upon the outlay; and this is of the greater importance at the commencement of such an undertaking, as it is stated that the actual numerically productive rate is not more than one-third of the highest attainable rate through a submarine cable.

The southern route, whatever its commercial or other advantages, has not as yet been adequately surveyed, and may, therefore, for the present, be dismissed.

The northern route presents the advantages of short circuits, and has been surveyed by Sir Leopold McClintock and Captain Allen Young, to a sufficient extent to enable a judgment to be formed on its suitability for the purpose, and, since 1860, the state of knowledge as regards the northern, is in almost the same position as the state of knowledge was in 1856 as regards the central route.

The northern route would present four sections of the following distances, according to the results of the survey above referred to, viz. :—

I. Scotland to the Faroe Islands .	225 miles.
II. The Faroe Islands to Iceland .	240 "
III. Iceland to Greenland	670 "
IV. Greenland to Labrador	510 "

Total 1,645 miles.

The laying of the cable for these distances, and its submersion to the ascertained depths, will present no serious difficulties. The bottom of the ocean on the northern route is said to consist of shells, weeds, crustacea, with other animate and inanimate productions, presenting a favourable bed for the cable. The number of shore ends on this route, namely, eight at the least instead of two, presents a disadvantageous comparison with the central route, and is a subject for serious consideration in the selection of the route. The disadvantages of the northern route are the character of the region, in which the laying of any cable could go on only during a certain few months in the year, the icebergs and glaciers, and the volcanic character of the arctic regions. It must be borne in mind that the cable, when submerged, is at the bottom and not at the surface of the sea of those ice-incumbered regions, and that anchors, creepers, and trawl-nets, are more formidable enemies of a submerged cable than the floating iceberg, whose under surface is gradually diminishing under the more genial temperature of the lower strata of water. The submerged cable in the Northern Atlantic, would, in the opinion of the most experienced sailors, run little risk of damage from such causes, whether from the Arctic storms, however terrible, or from the clash and destruction of icebergs on the coast of Labrador in a winter's day, whatever may be feared from the volcanic and magnetic character, or from the aurora borealis of the region, or from the impossibility of repairing a damaged cable in the winter time between Iceland and Greenland or Greenland and Labrador.

The selection of the central or of the northern route must, as in other cases, be matter of compromise, after mature examination into all the circumstances of the case. An accurate knowledge of the bottom of the ocean is of the greatest importance to such a question, but even this knowledge may be bought too dear. Soundings in deep water, say from 1,500 to 3,000 fathoms, over a breadth of 4 or 5 miles, present serious difficulties, and would occasion a delay unfavourable to the success of the enterprise. Such lines of soundings, if attained, could not be kept during the submersion of a telegraph cable occupying many days and nights, during a considerable portion of which, in the fogs and the average weather of the Atlantic, no observations can be taken, while the speed of the vessel must frequently be so slow as to render her more than usually liable to get out of her course. A uniform level plateau, however desirable, is in no respect essential to the submerged cable, for the ridges and inequalities at the bottom of the ocean, in deep soundings, are not sharp knife edges likely to cut through a protected cable, which, in such

places, is incomparably less liable to injury than a cable in shallow water, subject to abrasion on a rocky bottom, or to the action of anchors. The time is probably not far distant when cables will be laid on all of the three Atlantic routes, as well as on the Russian route, by Siberia and the Aleutian Islands, but in the inception of the important enterprise of the telegraph between Great Britain and the Western World, every energy should be concentrated on that route which affords the best prospect of the earliest and greatest commercial success.

The question of the cable is secondary to the selection of the route, as the weight, dimensions, and construction of the cable would in all probability be different for the central or northern Atlantic. The weights of some of the principal cables are as follows :—

Punard to Zandwort.....	11 tons per mile.
Boulogne to Folkestone	10 "
Orfordness to Haerlem	9½ "
Dover and Ostend	} 8 "
Frith of Forth	
Corsica to Sardinia.....	
Dover to Calais	7 "
Malta and Sicily	3½ "
Malta and Alexandria	2½ "
Red Sea	1½ "
Atlantic	1½ "

The heavy cables at the head of the above list are submerged in shallow water, and in situations for the most part liable to considerable risk from anchors and other interferences. The Atlantic cable is only about one-tenth the weight per mile of the heaviest of the above, and many persons of authority and experience in submarine telegraphy advocate a much lighter cable, one whose specific gravity shall not be greatly in excess of water.

The constructive submersion of the cable involves several important questions. Exception has been taken to the spiral laying of the outside or protecting wires of iron as having a tendency to throw the strain on the insulated conducting wire of copper, as well as to compress and displace the insulating material. The pressure of the water at great depths will have a tendency to compress and condense the insulating and other materials of the cable, but owing to the equality of pressure on all sides, there will be no tendency to displace that material as originally disposed in the cable, however great the compression or distention by the elongation of the cable, in reference to which, however, it must be borne in mind that the relative ductility of copper and iron is in favour of copper, so that the iron wires, unless the spire of the coil was considerable, would practically bear the strain.

The pressure and strain to which a cable may be subjected, and their effects on the insulating material, whether gutta-percha, india-rubber, or any of the compounds or products of modern science, may be ascertained by careful experiment and observation on land. Much may also be done in observing the effects of temperature on the insulating material under pressure, and the collective wisdom of men of science might do much towards arriving at a correct opinion as to the effects of magnetism and the aurora borealis on the submerged cable, and whether the effects would differ in kind from the disturbances which the telegraphic instruments experience during lightning and other electrical exhibitions, the laws of which, thanks to the labours of General Sabine and Admiral Fitzroy, are becoming gradually developed.

The laying and submerging of the cable involves geometrical and mechanical questions, which may also be reduced to certainty by experiment. The tendency of lines to twist, as observed in deep-sea soundings, is a source of difficulty in paying-out and submerging a telegraphic cable. The spirals of the cable afford an easy passage or line for the water, and, as the cable is paid out, the turns will accelerate; this prejudicial effect may be modified and corrected by care in the coiling and laying of the cable.

The character of the curve assumed by a cable, as laid in the water, will depend on the rate of its sinking and of its paying-out, that is, the rate of the ship. If the cable sinks faster than the speed of the ship, the concavity of the curve will be upwards or towards the surface of the water, and the convexity of the curve towards the bottom; but the cable in attaining this position will have presented a curve having a contrary flexure, in the language of geometers, which, in a cable of great weight and thickness, may lead to serious inconveniences.

If the cable should sink less rapidly than the speed of the vessel, the curve of the cable will be convex towards the surface, and concave towards the bottom of the water.

The motion of the vessel being necessarily irregular, those curves will become irregular, so that a portion of the cable may be deposited in coils or waves on the bottom of the ocean, and afterwards drawn together into what are technically called kinks, from which serious inconveniences have resulted.

The existence of such curves of contrary flexure are unavoidable in paying out a cable, whether lowered vertically or inclined, if the paying out is checked on board the ship, as it must inevitably be in laying a heavy cable. The consequences of the position assumed by the cable under a heavy sea may be very serious; so long as the cable lies away from the vessel in a position assumed by a chain cable when taut by a vessel at anchor, the vessel and cable will rise with the wave. But if the cable becomes vertical, inasmuch as a heavy body like a vertical rope, cannot be lifted vertically on a sudden jerk without an enormous strain. The rapid lifting of a vessel by the waves of the Atlantic may produce a strain which may injure or even break a cable so lifted; hence the necessity of having recourse to very elaborate machinery in the laying of the Atlantic and other heavy cables.

These and other difficulties connected with the submerging of heavy cables, have given rise to suggestions for making the cable as light as possible consistent with strength, and of a specific gravity but slightly in excess of water. Such a cable could be laid on the water from a vessel steaming at its full speed, a great length of cable lying nearly horizontally on the water, and sinking gradually at a slow rate, and adapting itself to the irregularities of the bottom. The cable would be subjected to a tension due to the velocity of the current of the water through which it was being submerged; the tension due to the weight may be disregarded in such a cable, whereas in a heavy one the tension is due to the weight, and the tension due to the current may be disregarded. In laying such a light cable, the tendency of the cable to run out or slip away from the vessel is so slight, that the elaborate regulating machinery required in laying a heavy cable for preventing the cable slipping away will be unnecessary, and may be dispensed with. Whatever may be the tension due to the action of the currents, either on a light or a heavy cable, the tension due to the weight of the latter must be superadded, and the tension from the action of the current on the enlarged surfaces of the heavy cable will not be inconsiderable, so that the total tension on a heavy cable is very serious amount.

Viewing the laying of the cable on theoretic principles, with reference to the action of the resisting forces, the light cable would appear to present so many advantages over the heavy cable, that the adoption of the latter in preference to the former will depend on other considerations, the result of actual experience.

The strain to which a cable is subject during the laying may be accurately determined by experiment and calculation, and this part of the question may be placed in the same category as the effects of temperature, of pressure, of extension, or of the comparative qualities of different insulating materials.

On the best construction of the cable, whether a combination of insulated copper wires laid centrally and spirally, protected by the iron wires laid straight, or nearly so, with hemp, asphalt, and similar materials, or other of

the various combinations suggested; also, on the best system of insulation or insulators, whether gutta percha, or india rubber, or compounds thereof, or other substances now in existence, and already, or hereafter, to be applied, an inquiry conducted by competent persons may lead to the most important results.

In conclusion, I would suggest whether this Society may not be able to promote and facilitate such an inquiry, and materially to contribute to the solution of the question of the best system of telegraphic communication with the great American continent.

DISCUSSION.

The CHAIRMAN said, before the discussion commenced it might be well that he should place before them the exact position in which the question stood. They would recollect that a paper on this subject was read by Mr. Masey a fortnight ago, and in consequence of the great interest of the subject, and the great number of gentlemen who wished to speak upon it, it was understood that the discussion should be resumed as soon as the Council could find a fitting opportunity. By the kindness of the gentleman whose name had been put down to give a paper this evening they had been able to arrange for a renewal of the subject on which Mr. Webster had just read his paper by way of introduction. On the last occasion the discussion was chiefly directed to the mode of laying down the cable—he hoped this evening it would turn more upon other points. He begged to call upon Mr. Jenkin to open the discussion.

Mr. FLEEMING JENKIN was very glad to hear from the Chairman that it was thought advisable that the discussion should embrace other topics than those which were touched upon at the last meeting. He thought it was necessary that some of the points adverted to in the paper of Mr. Masey, and in the subsequent discussion, should be treated by those who had had practical experience in these matters, which he (Mr. Jenkin) might lay some claim to. First, he would allude to the statement of Mr. Masey with regard to the arrest of the chemical action in cables laid at great depth in the sea, and their non-liability to decay. Upon that question he would say that experience showed them that they could not hope for quite such a favourable result. The almost total decay of the iron-wire covering was the cause of the failure of an attempt to repair a cable on which he (Mr. Jenkin) was engaged in the Mediterranean, and the wire at the depth of 1,200 fathoms was very much decayed, showing that oxidation of the metal had taken place at that great depth. He might add that on the same occasion he obtained evidence in corroboration of what Dr. Wallich had stated as to the existence of living animals at that great depth, which could not be the case unless chemical action was carried on. He had brought with him some of the eggs of a species of cephalopod; these were attached to a cable raised from depths of between 700 and 1,200 fathoms, and when the eggs were opened the embryo fish lived for a short time. That being the case, he was afraid they could not count upon any of the materials which were not permanent in shallow water being permanent in deep water; and, therefore, if iron wire were used for the cable, it must be protected against oxidation: if not, the cable would probably in time break up into short lengths. Reference was made at the former meeting to the spiral form of the wire covering. It was an almost universally received opinion on the part of the public that the spiral covering allowed the cable to stretch so as to injure the interior core, to a very great extent, as compared to what would be the case with a solid rod of iron. Now, considering it had been the universal practice of telegraph engineers ever since these cables were made—at any rate for shallow water, and in a great many instances for deep water—to use the spiral form of protection, he thought some doubt should have arisen in

the minds of those who advanced that statement, and it would have been well if they had tested their theoretical conclusions by actual experiment. He would refer on this point to the experiments which were printed in the Blue Book of the evidence received by the Board of Trade Committee, from which they would find that whereas half the breaking strain of a single wire caused an extension of from 0.15 to 0.18 per cent., a cable covered with these spiral wires was extended 0.3 per cent. with half its breaking strain, and that the breaking strain of a single wire caused an extension of from 0.4 to 0.5 per cent.; while the breaking strain of the cable caused an extension of 0.7 to 0.85 per cent., so that really there was no material difference between the two. The cable stretched only a small fractional percentage more than the solid wire would do, and that was not mere theory, but had been proved hundreds of times by himself. The reason for this would be very apparent, when they looked at the matter a little more closely. If they took a single wire in the shape of a corkscrew it would elongate with a very small strain, because its diameter could diminish without experiencing any very sensible resistance; but when they put a series of corkscrews round a cable so that one butted against the other, the diameter of every one of those corkscrews could not diminish because they formed a complete arch of solid wire all round the cable. In order to diminish the arch, they must squeeze each wire flat, or at least oval, and the consequence was that the spiral covered cable, as regarded extension, acted almost like a solid rod. The form in which it was disposed presented a great resistance to pressure. The arched form of the wires prevented pressure coming upon the soft gutta-percha and hemp of the core, whether from longitudinal or casual strain, and made the most perfect protection against external injury which, in his opinion, had ever been devised. Nevertheless, he believed the interruption to the Atlantic cable had been ascribed to the proper causes, viz., the slight extension of the cable, and the separation and reclosing of the copper wires. The slight extension, though only a mere fractional part of the total length, would be sufficient to separate the copper wires if they had been previously broken, and to allow them to come into contact again when the strain was removed. It was well known that some joints had been carelessly made, and probably the failure occurred at one of these. He thought that was not likely to occur again. The copper wire was in seven parts, and had been carefully tested and inspected, but if, as was now most improbable, some break did exist through all the copper wires at one point, the same result of separating the wires at this break and allowing them to close after the strain was removed, would occur even if they had a solid steel tube round the cable; indeed, the solid steel tube would stretch more before it broke than the spiral cross covering, although it would bear a greater strain. He might mention that cables had been picked up from a depth of 1,500 fathoms, and the gutta-percha was found to be uninjured, and the iron wire not disturbed nor the diameter distended. The whole thing had been brought up in the same state as when it went down: therefore, to suppose that there was any practical objection to the spiral form of covering was, in his opinion, a fallacy, as had been shown by the many specimens which had come under his personal attention. Not only was the outer covering of the cable recovered from great depths free from defects, but the gutta-percha insulator was uninjured in the way which was stated on the last occasion. One speaker went so far as to assert that a pressure of two or three tons per square inch upon the gutta-percha for a few hours, caused it to absorb so much water that insulation was destroyed. There was not the slightest foundation for such an assertion. He had the strongest proofs to the contrary in the condition of the gutta-percha in cables he had picked up, after it had been submerged in great depths for three years. The insulation of the wire was perfect while at the bottom of the sea, and when it was picked up, the

gutta-percha itself was as good as on the day on which it was sent out of the manufactory. The same fact was daily confirmed by the application of artificial pressure. To give them some idea of the perfection to which insulation by gutta-percha had been brought, he would state this fact. If 2,000 knots of a cable similar to the Malta and Alexandria cable were taken for the Atlantic, and the core maintained at 60 deg. temperature, out of every 100 parts of electrical current that was started, 97.85 would arrive at the further end of the 2,000 nautical miles of cable, which showed a loss of electricity of only a little more than 2 per cent. Under these conditions, in conformity with electrical laws, which he need not enter into, more current started than if the cable were absolutely perfectly insulated, so that if they compared the current (with a given leakage) which would arrive in America through such a cable as the Malta and Alexandria with that which would arrive through a cable with absolutely perfect insulation, the difference would only be 0.7 per cent. instead of 2.0 per cent., showing clearly that any further improvement in the insulating material was not required, and even if kept at a heat of 75 deg. Fahr., the difference would be inconsiderable. In the case of the old Red Sea cable, at 75 deg. 62 per cent. of the entering current would arrive at the end of 2,000 knots. These were not mere theoretical calculations, but were results which he had confirmed by actual experiment, when lengths as great as 2,000 knots were at his command, and he would add that it was well known that pressure improved instead of deteriorating the insulation by a small percentage. With reference to the retardation of the signals, mention had been made of a limit in point of distance, beyond which it was suggested they might not be able to transmit signals. He would say there was no such limit. If they had a cable to the moon they could send signals through it; but through any one cable of given length and dimensions there was a limit to the number of distinct currents, and consequently to the number of distinct signals which could be sent through that cable, and that limit was, as Mr. Webster had stated, inversely as the square of the distance, and, therefore, *ceteris paribus*, short spans were desirable. Where a given ratio between the copper wire and the gutta-percha was kept to, the number of words that could be sent per minute through any one length with any core was simply proportional to the quantity of materials used; so that, as it were, they got so many letters per pound of material employed. If they wanted ten words per minute, they must use twice as much material, both copper and gutta-percha, as if they required to transmit five words per minute. The actual speed in words through every given length of cable was a matter on which all electricians differed a little—not as to the electrical laws themselves, but from the employment of instruments more or less efficient; but he was certain that a speed of transmission through 2,000 knots of cable could be obtained, which, if the cable were permanent, would return an excellent dividend for the outlay. With reference to light and heavy cables, the curves assumed by the cable while being laid, the strains which came upon every part of it, the strain which was necessary to lay it taut, and the loss which was sustained if it were laid with less strain—all these points were very ably treated in a paper by Messrs. Brooks and Longridge, read about three years ago before the Institution of Civil Engineers. The conclusions at which those gentlemen arrived upon theoretical grounds he had proved in practice to be correct. Their mathematical investigation was singularly complete and perfect, and he was surprised that very able paper had not been more often alluded to. The case against heavy iron cables, such as he had heard were proposed for the Atlantic company, was this, that in order to lay the cable along the bottom of the ocean without any very great loss, they must put on a strain in paying it out which was equal to the weight of the cable hanging vertically from the side of the ship to the bottom of the

sea, and in order to pay out the cable taut, such a strain was required, that for every thousand fathoms approximately they must put on a quarter of the breaking strain; so that in 2,000 fathoms they would have half the breaking strain; and if they diminished that strain only a very little, they lost a great deal of cable; so they had what engineers called a co-efficient of safety of only 2; and with a cable of great specific gravity they had the disadvantage that if they did not put on the full strain necessary to lay the cable taut at the bottom, they very rapidly lost a large per-centage of the cable; so that, with a cable of the specific gravity of the old Atlantic cable, payed out in a depth of 2,000 fathoms, at the rate of $4\frac{1}{2}$ knots an hour, they lost 25 per cent. of cable if the strain were 3 per cent. too small, and 50 per cent. if the strain were 10 per cent. too small, according to Messrs. Brook and Longridge's tables. Now, with a cable of light specific gravity, even if it were of the same absolute weight and strength, they might diminish the strain 20 per cent. before they lost 25 per cent. of the cable, at the same speed; and if they went faster—say seven knots per hour—they might diminish the strain 70 per cent. before they lost 25 per cent. of cable. That to his mind was the real argument in favour of light cables. The great difficulty was to get a cable which should remain permanent when laid. He had no doubt before long the problem of a permanent cable in deep water would be solved. There were some other points which he might refer to, but he thought he had already occupied as much of the time of the meeting as he had any right to do.

Mr. THOMAS ALLAN remarked that the first question to be decided in establishing a telegraphic communication between Great Britain and America was as to the cable itself; the route by which it should be laid was a matter which could be determined hereafter. What they wanted was, in the first instance, a cable that would meet the requirements of the case, suitable for being submerged in ocean depths without injury to its electric conductivity. It was quite evident, as the result of all experience, that the cables hitherto constructed were only suitable for shallow waters, and not for ocean depths. What they required was a cable of light specific gravity, and that the combination of materials should be such that, in the laying there should be no injury to its working condition; also, that its bulk and weight should be such, that in case of necessity they might be able to recover long lengths of the cable. They knew that in the case of the Atlantic cable, with its comparatively small bulk and weight, it almost swamped the *Agamemnon*. In order to encourage them in this matter, there had been given, on a former occasion, a long list of cables successfully laid; but he had not seen a list of the failures. Cases were multiplied of the submerging of cables in shallow waters; but there was only one in existence which was really in ocean depths, and that only for a short distance, and within the last few weeks it had been found that that cable had followed the fate of its predecessors, which was an additional evidence of the inapplicability of those cables for such purposes. It broke in submerging; it was picked up and repaired; and that fact was sufficient to prove that there were errors in the principle of construction. The successes were certainly very great successes, much greater than could have been expected, because from the way in which the cables were constructed, they might have expected failure rather than success, and he looked upon them as "happy go lucky" successes. They must go to the great failure of the Atlantic cable to guide them for the future. Its unsuitability in point of conductive power was not the main question, which was simply a mechanical one—the doubt was, whether such a cable could ever be submerged to that great depth without destruction to its internal or electrical portion. On the last occasion they were told that the cable would never have spoken at all but for the ingenuity of the instruments prepared for the purpose, and that the signals

were so slight that they could scarcely be recorded at the other end. It was clear to him that any other cable constructed on the same principles would equally fail in accomplishing the object sought. He had been informed that the new Atlantic cable was intended to be of extra weight and strength, but in proportion to the extra weight were the chances of elongation of the cable, and a similar destruction of the core to that which occurred in the former case. At the time the Atlantic cable was laid, he predicted that it would not work after it was submerged, and the *Times* expressed its opinion that although it might work temporarily, it would not answer permanently, from the principle on which it was constructed. Mr. Allan proceeded to describe the principles on which he had constructed a cable, in which the strength was placed where he contended it was most required—viz., in the centre, the outer covering being of light specific gravity. Upon that principle he contended that the electrical condition of the cable was best maintained, and by that means the probabilities of a permanent communication were greatly enhanced.

Mr. WALTER HANCOCK said that, in conjunction with his father, he had devoted to the manufacture of gutta percha the nineteen years since its introduction into this country, and he would make a few remarks upon the important relationship in which gutta percha stood to the science of submarine telegraphy, in its present crisis and in its probable future. He would refer especially to matters of immense importance that had not had their due weight with electrical engineers when designing cables. It was notorious that they had committed great errors, which had resulted in costly failures. In round numbers, 10,000 miles of lost cable, worth £2,000,000 sterling, were lying at the bottom of the sea, and the startling fact that that portion of the resources of the country, instead of remaining in our hands in a productive form was lost to us for ever, confronted us, at once a monument of our past ignorance, and a beacon for our future guidance. Had we fully profited by the experience of the past? He feared not. The following vital points were still unsettled:—1st. The size, form, and construction of the conductors. 2nd. The insulating material we ought to adopt, and the quantity we ought to employ. 3rd. The form, nature, and specific gravity of the material to be used as an external protection. 4th. The all-important question of the just relation and proportion that should exist between these three essentials, conductor, insulator, and protector, in order to adapt them to particular situations, and particular depths. These questions, too often solved hitherto by predilection for some one particular theory, must in future be decided by the unerring oracle of scientific truth. It behoved us at this crisis in submarine telegraphy to take a comprehensive survey of the stupendousness of the work to be accomplished, and the comparative scantiness of the means that Providence had at present placed in our hands for its accomplishment. The work was nothing less than to establish the supremacy, the universal empire, of telegraphy over the entire globe. It was generally acknowledged that if we had at this moment 20 cables to America, 20 to Gibraltar, Malta and Alexandria, and from thence 10 to India, 5 to China, and 5 to Australia (and these would require about 200,000 miles of insulated wire), we could make constant use of the whole, provided only that they were economically constructed and worked, so that the tariff for messages might be moderate. He thought we could not afford to postpone for 50 years, or possibly for a century, the completion of these lines that were required for our service of to-day. But that this would be the inevitable consequence of pursuing the course that had been hitherto adopted was not a mere assertion, but a fact, demonstrable by the following statistics:—The average importation of raw gutta-percha for the last 10 years had been 750 tons per annum, and it was only maintainable at this rate by a gradual advance in price from 1s. to 2s. 3d. per pound. But of this quantity, 300 or 400 tons only were of a quality suf-

ficiently good for telegraphic purposes; an increase to 500 tons might be possible, with extraordinary exertions and a further advance in price. Now, if it were necessary that the cables referred to should be heavily insulated, for instance, with 550 lbs. of gutta-percha per mile, as it was to be feared that the Atlantic Telegraph Company (so far as they had given any indication of their views), would probably decide upon, should they be successful in raising the £600,000 they asked for, it would be obvious that the 200,000 miles referred to would require 50,000 tons of gutta-percha, and that it would require 100 years supply, at the 500 tons per annum, to produce this quantity. Or if we covered one half of our cables with india-rubber, it would occupy 50 years. Unfortunately the supply of india-rubber stood in the same predicament; the average annual imports of the best, or Para, india-rubber being about 1,000 to 1,200 tons, nearly the whole of which was absorbed in the ordinary india-rubber manufactures of the country. These facts spoke eloquently to us all; they told the manufacturers of gutta-percha and india-rubber that they must economise the expenditure and increase the efficiency of their materials, they told the electrician that he must direct his attention to reducing the size of his conductor, so that the economy of insulating material may be fully carried out. An opinion prevailed, and he believed it to be well-founded, that it was not necessary to expend £600,000 in the construction and laying of a cable across the Atlantic. He considered that a good serviceable cable could be laid for £250,000, and that that amount might ultimately be reduced within £150,000 or £180,000. The necessity for economizing the gutta-percha was not a recently formed opinion; his evidence in the Blue Book published by the Government Committee appointed by the Board of Trade, would show that this subject had long engaged his attention. In proof that this economy was practicable, he stated that he insulated a wire with 105 lbs. of gutta-percha with four coats, and that upon repeated testings, side by side, after 12 months submersion, it was absolutely identical, both in its insulating power and in the smallness of its induction, with the wires so often referred to in the Blue Book as the 20-coat sample, which was insulated with 330 lbs. of gutta-percha. This sample cost £100 to £120 per mile, while his sample would cost £20 only. Referring briefly to the moot point of the value of intermediate compounds, and specially to that one known by the name of Chatterton's compound, he stated that too much reliance should not be placed upon them, because it was evident, from the rationale of their operation, that they improved insulation in inverse proportion to the otherwise defective state of the work upon which they were employed; and because they rendered the gutta-percha upon which they were employed more susceptible to the injurious effects of heat, either in warm climates or in the hold of a ship. With regard to cables for deep seas, he believed that we should ultimately come round to the adoption of hemp, the cause of which had been for many years very ably advocated by Captain Rowett. Those who advocated iron, opposed hemp on the ground that it would perish; but what was their practice? In Mr. Masey's paper it was stated, "It is now acknowledged by all connected with the science that the outside wire should be protected from corrosion by hemp and other substances." Now, if hemp was not able to take care of itself, how could it permanently protect the iron? The cables of the *Royal George*, after fifty years submersion, came up sound. The alleged tendency to decay might, in all probability, be arrested or prevented by a preservative solution. It would probably long survive any iron cable, and if it should ultimately perish he did not consider it of any great importance, because, for seas of extreme depth, he regarded an external cable as necessary principally to protect the core until it reached the bottom, and that, if the core once reached such a depth safely, and maintained its electrical effi-

ciency for one month without diminution or variation, he believed that that core would remain safe and reliable until the cable had paid for itself. In conclusion, he would express unbounded confidence in the future of submarine telegraphy. Our failures had arisen from causes that were remediable; we must avoid them in future—renounce the predilection for any particular theory, economise our resources, and enlist the sympathy and co-operation of all who were willing to advance the cause. Then, and not till then, the triumph of submarine telegraphy would be assured. The wonders that it had achieved and was daily achieving, foretold the certainty of its triumph. Already it furnished in our morning journals the record of what had passed in all the capitals of Europe in the previous day; the day would come when, outstripping the sun, it would also record in the morning, not what the Emperor of China, or the Tycoon of Japan, proposed to do, but that which he had done in the previous afternoon.

Dr. COLLYER said he was in the United States in 1857, and having then seen the nature of the telegraph the company were about to lay down, he wrote to them a letter, an extract from the reply to which he would read. He did so, he said, in order to show that he was not exactly a novice in the matter now under discussion. He had not only made experiments in telegraphy on a large scale, but he had been associated with gentlemen largely connected with the subject. The great point was to have a good conductor and a good insulator, and that the induction caused by the external wire now used to protect the conductor should be reduced as much as possible. In 1857 he proposed to the Atlantic Telegraph Company that a large core made of copper (a good conductor, say a quarter of an inch in diameter, should be employed, and that the strength of the cable should be in the centre. He believed that mechanically, as well as electrically, if that suggestion were looked at without prejudice, it would be found to be right, and that the proper place for the strength of the cable was in the centre. If the strength were external and not internal, there would be a breaking of the internal structure. At that time gutta-percha, not having been brought to such a state of purity as at present, was a great source of leakage, as far as the insulation was concerned. He proposed a large conductor of copper; and not a very large proportion of gutta-percha covering. One word with regard to the aurora borealis. In conversation with Dr. King, who went in search of Captain Franklin, he was told that the aurora was merely the effect of magnetic disturbance, not the cause, and therefore the objection that was raised, that the aurora would cause a disturbance in the cable, had no weight.

Mr. CROMWELL F. VARLEY wished to correct a few erroneous notions which had got afloat. The first was as to the condition of the old Atlantic cable before it was laid. That cable during its manufacture was injured, to a great extent, by exposure to the sun. So much did it get heated at one of the manufactories, that the gutta-percha was found oozing out through the external covering. All those portions that showed signs of imperfection were then cut out; but, necessarily, the eye could not detect all the places that were injured, and when that cable was put on board ship, and taken to sea, and then, not being laid, was taken to Keyham and put into a tank, it underwent many operations of testing and cutting out the defective parts, and he was told that many of the parts had not been put together carefully. More than that, recently he had seen many parts of that cable in which there were nothing more than bell-hangers' joints covered over with gutta-percha. He (Mr. Varley) had made some inquiries from Professor Thompson as to the state of the cable before it was laid, and he had gathered from that gentleman's memoranda that a serious fault had been shown to exist not many miles from the end that was landed on the Irish coast. When the cable was made, it was not put under water; it was never placed in the element in which it was to operate until it was actually submerged. Consequently any defect in it could not at first show itself.

Still, defects manifested themselves in the cable. Although it was dry, defects showed themselves sufficiently to account for the non-success of the cable when laid. As to the thickness of the insulating material necessary for a deep sea, he believed it was very small. A piece of wire merely covered with gutta-percha had been tested in the usual manner with 500 cells of Daniel's battery, and it resisted the action for a very considerable period—in fact, it did not break down at all. He had frequently submitted gutta percha of the thickness of a thousandth of an inch to the same test, and successfully, for above twenty minutes. Sheet gutta percha, when made ten years ago, was comparatively opaque and porous, looking almost like calico, whilst now it was impermeable and transparent. Still there was a certain amount of porosity which required to be guarded against, and this could be done by covering the wire first with a layer of gutta percha, then with a non-conducting, soft, adhesive material, such as that known as Chatterton's compound, and then again with a layer of gutta percha, which would thus adhere to the first, and, by repeating this process, the defects in the insulation could be reduced to a minimum. It was stated that a cable thus covered had failed, but this was not the case, for a man on board the ship had been bribed to drive a nail into the rope, which, of course, destroyed it. It might be true, as Mr. Hancock had stated, that when the wires covered with Chatterton's compound were tested before being laid, against those covered simply with gutta-percha, the decision was in favour of the wire on which Chatterton's invention was not used. At the lower temperature, however, of the bottom of the sea, the decision was just the reverse. Last year he laid down a new wire covered with Chatterton's compound, and the insulating power of these wires was considerably greater than that of those not so treated. He would not enter into the dispute between gutta-percha and india-rubber. Gutta-percha had done good service, and experience did not warrant a change in the material to be employed. The insulation secured by the gutta-percha was more than sufficient for the transmission of messages across the Atlantic, and he therefore rested content with that material. To hear the observations which were constantly made, one would suppose that the Atlantic Telegraph Company desired to work in the most blundering way possible. This was not the case. The Atlantic Telegraph Company, during the lifetime of Robert Stephenson, had his name attached to their enterprise. Mr. Fairbairn was also among them, and he was sure he need not mention other names to warrant the assertion that the highest talent had been secured to assist the Company. A great deal had been said about the cable which the Atlantic Telegraph Company were going to lay, and although he must pay Mr. Jenkin the compliment of saying that he agreed with him in almost everything he had said, he, in speaking of the cable which the Atlantic Company was going to lay, had really gone beyond his knowledge, as no decision had been come to as to the kind of cable to be used.

Mr. JENKIN said he had spoken of the old cable, or had meant to do so.

Mr. VARLEY would say no more on that point. When the Sardinia and Bona submarine cable had been maliciously injured, and the wires were taken up, it was found that the insulation at the depth of 1,600 fathoms, after five years wear, was perfect. It was true that the Algiers telegraph was out of order, but that was not in deep water, but near the shore. The cable from Spezzia to Corsica, laid in 1854, was at this moment in perfect working order, and had never cost a farthing for repairs. It had been said that tension of the wire spoiled insulation. Now he had frequently had to deal with wires that had been very considerably stretched, and he remembered that when a portion of the Metropolitan Railway gave way between King's-cross and Euston-square, the telegraphic wires went down several feet without destroy-

ing the insulation, although it was afterwards ascertained that the tension had been so great that it was necessary to cut out four or five yards of the wire.

Mr. HUXLEY said there was a point of view in which the question must be considered, but which was escaping the notice of the meeting. Although a great deal of learning had been displayed as to insulation and induction, the great question in the mind of the public was the expense. To him three points, three principles, seemed to be settled—one, that a cable should have perfect insulation; next, that the outer covering should not be subject to injuries from external sources; and thirdly, that the cable should be flexible, without liability to be broken or kinked. The issue came to this:—whether metallic coverings were proper for the purpose. Whether they could be made *so light as* to fulfil the necessary conditions was questionable; if that could be done then one difficulty was solved, and this would go further, in his opinion, to settle the matter than anything else. It seemed, however, to many, that iron or steel coverings would not satisfactorily fulfil the conditions. There were exquisite specimens on the table of that covering and of other coverings, but he thought they should consider whether it could not be proved that iron was not suited to the purpose. On the table there was a specimen of an exceedingly light cable, covered with rattan cane. It could be made of any degree of weight necessary to submerge it, and it appeared that the covering of silex was absolutely impervious to the sea, impervious to insects, and would wear for any length of time. He thought this, then, fulfilled many of the requisite conditions. It did not heat under any circumstances, and its indestructibility was familiar to us all.

The Right Hon. J. STUART WORTLEY desired to tender his thanks to the Council of the Society for their courtesy in permitting him to be present, and to take part in this interesting discussion. But he was perfectly conscious that that courtesy had been extended to him, not on any personal ground, but on the ground of his position as chairman of the Atlantic Telegraph Company. At the time of its failure, he had no connexion with that Company beyond the embarkation in it of a moderate amount of capital, to which he was tempted by the grandeur and the great prospects of the undertaking, not in a commercial sense, but in a national and general sense, as one of the greatest undertakings conceived by the mind of man. His object in presenting himself was to remove misconceptions, and the principal error he wished to correct was this:—it had been stated that the Atlantic Telegraph Company had determined to do this and had settled to do that. Now he might, as Chairman of that Company, expose himself to ridicule, if he said they had settled nothing; still he was prepared to believe that, in taking that course, they had taken a truly scientific and wise course. Hitherto they had been without sufficient information. Numerous experiments had been made, by which a great deal of light had been thrown on the subject, and he took some little credit on himself for having suggested to the Government the appointment of a commission, and having suggested to that commission the taking of evidence by word of mouth instead of by written papers, the consequence of which had been the collection of an amount of information which, if properly used, would be productive of immense benefit. This information had not only been circulated in England, but in France, for he had seen in the *Revue des Deux Mondes* an article in which the contents of the Telegraph Blue-book were fairly and fearlessly discussed, and it was admitted that a great step had been taken in the science of sub-marine telegraphy; and while credit was given to the company for being the first to imagine the possibility of achieving their great work, the *Revue* went on generously to say, the faults were not theirs, for that in those times they had not the lights which had since been obtained. One gentleman had spoken of the cable the Atlantic Telegraph Company was going to lay. It turned out that he meant to refer only to that which they

had laid. But then, why speak of a cable of heavy iron, that could not support itself? Another gentleman spoke of the immense quantity of gutta-percha the Company were going to waste, by throwing it to the bottom of the Atlantic, but he would ask where they learned either the form of the cable the Atlantic Company were going to lay down, or the amount of gutta percha they were going to send to the bottom of the sea? The fact was, the Company had decided nothing. They had obtained the best information, they were making experiment after experiment, but till the result of those experiments had been submitted to the judgment of scientific and practical men, and their opinion had been obtained, the Company would not decide what should be the form of the cable, or what would be the substance of which it would be composed. The Company had obtained the assistance of Mr. Fairbairn, upon whom the mantle of the two Stephenson's seemed to have descended; of Professor Wheatstone, avowedly at the head of electric science in this country; of Professor Thompson, of Glasgow, and in their own service of Mr. Varley, who had addressed the meeting to-night. These gentlemen would investigate the various schemes and the prospects which they held out, and when they had formed their judgment, the Company would carefully weigh their recommendations. It had been represented that the Company had entered into a contract with a monopolizing firm, and had bound themselves hand and foot. But this was altogether untrue. The company were free to make contracts with any one. They were bound to no form of cable, to no mode of manipulation. Whatever its faults, the company had not rushed into the enterprise without due deliberation. They had kept their hands free from prejudice and from all commercial and other restrictions. Allusions had been made to the failure on a former occasion. Mr. Varley had, he thought, sufficiently accounted for that; but it was well known that, so far from that failure being a matter of astonishment, it was a miracle, indeed, that the cable ever spoke at all. Those who projected it knew little of the subject; those who manufactured it were without experience; there was not time for the work; the manufacturers of the two portions failed in making the twist in both in the same direction. A high authority, who saw the cable at Liverpool before it was shipped, pronounced it impossible that it could ever be of any use. They were, however, far from being discouraged by their first failure. The *Revue des Deux Mondes* allowed that the Atlantic cable had failed, but it added that it had established the fact that the electric current could be transmitted through long lengths, and that the failure was wholly owing to surmountable difficulties. In point of fact, he believed the general opinion to be, that so far from deep water being an impediment or a source of failure, the deeper the water the safer would be the cable, and the farther removed from accident. The greater number of failures of electric cables had, in fact, been in shallow water. It had been said that there was only one telegraph at work in deep water, and the Algiers cable, in 1,600 fathoms, was referred to, but the cable communicating between Toulon and Minorca, which included deep water, was perfect at that moment. The Company were anxious to obtain all the information in their power before again attempting so great an enterprise.

Mr. HANCOCK expressed his pleasure at hearing that the Company were not bound to any particular form of wire, or to any particular mode of insulation.

Mr. JENKIN explained that he might have been in error in using the term "new Atlantic cable," but his calculations were all based on numbers from Brook and Longridge's paper on the old Atlantic cable.

Mr. C. W. SIEMENS was of opinion that discussions like these did a great deal to spread a perfect knowledge of matters connected with so vast an undertaking as the Atlantic cable. There was no doubt that a light cable could be made to speak. It was a question for the share-

holders how quick they wished it to speak, and then it was a question what quantity of material could speak the best. With regard to the outer coating of the cable, he thought that most important. Electricians knew pretty well what could be done with a given material, and there might be different plans of putting it on. Some might be in favour of one material and some of another; and they knew that with a given quantity of gutta-percha or india-rubber they could obtain insulation, but in deep-sea cables the quantity of outer covering was of great consequence. It was most generally admitted that a heavy cable was not suited for deep waters; and it was also admitted that a sheathing of some sort was necessary in order to protect the insulated conductor, not only in trans-shipment and paying out the cable, but afterwards in protecting it against the inroads of marine animals, or the accidental strains to which it might be exposed in lying on a rough bottom. As to what the best form of covering might be, he supposed the meeting would not agree, because, like most problems, after it had been plainly stated it might be solved in various ways, and most of those who were professionally engaged in those matters would form a rather strong opinion in favour of one form or another. But in meetings like this opinions were brought together, and he hoped to see the great enterprise of the Atlantic cable accomplished by one or various modes. He thought there was plenty of room for two Atlantic cables at least, probably for more. Before he sat down he would only remark that there seemed to be much misapprehension respecting the effects of earth currents upon the working of submarine telegraphs. It would appear, from Mr. Varley's observations on the former occasion, that the disturbing influence of these currents was very great, whereas, in point of fact, they were of no practical importance. The earth was no doubt a powerful magnet, as was proved by the appearance of the magnetic light at the polar surfaces, but no current would result from the terrestrial magnetism, except at the time of any change occurring in its intensity, and it was well known that these changes took place only very gradually. In making the necessary arrangements for the working of the Malta and Alexandria line, he had made no provision against earth currents, and the fact that the battery power in working this line had been limited to eight cells was the best proof that no such provision was necessary.

Mr. T. A. MASEY wished to say a very few words with reference to what had fallen from Mr. Jenkin relative to the strength of the outer covering of cables. The shore ends of the Dieppe cable formed a perfect cylinder, and were capable of bearing almost any pressure that could be brought upon them. In the shipping of that cable at the East India Docks, it was carried across the roadway, and one of Pickford's vans, heavily loaded with pig iron, passed over it, scarcely making an indentation in it. With regard to the Atlantic cable, he held in his hand a specimen which had been laid in about 2,000 fathoms, and it was found that although the wire covering had been strained to such an extent as to lay bare the gutta-percha, yet the insulation of the copper wires was good, and quite sufficient for conducting electricity through them. If that was a sample of what had taken place at such a depth, it was a proof that the iron covering did not give the support that was intended, and answered no good purpose beyond giving strength in the laying down of the cable.

Rear Admiral Sir EDWARD BELCHER, said, as it was impossible to arrive at a satisfactory conclusion from the discussion which had taken place, he would suggest that the Council of the Society be requested to appoint a committee for the purpose of prosecuting further inquiries into the subject.

Mr. OWEN ROWLAND said, he had been engaged by her Majesty's government under the Board of Trade, in conducting very extensive experiments in the testing of cables for sub-marine purposes. They had all heard of those experiments, but they had no idea of the great ex-

tent of them, or of the time and labour that had been bestowed upon the testing of the best materials for submarine cables. Those experiments were in part published in the blue-book, but they were not all recorded there. He was glad this subject had been taken up by the Society of Arts, because he believed the discussion of it would tend to increased confidence in the practicability of submarine telegraphy; and if the Atlantic Telegraph Company acted upon the information and instruction given in the report of the government commissioners they might confidently look forward to the time when a permanent telegraphic communication with America would be an accomplished fact, to the mutual benefit of both countries.

The CHAIRMAN said it was now his duty to close the discussion for this evening. With regard to the proposition of Sir Edward Belcher, that a committee should be appointed by the Society to conduct inquiry into this very important subject, he might state that the Council had already appointed a committee to inquire into the destructibility of gutta-percha and the best mode of its employment, but that committee had ceased its labours since the appointment of the government commission. Whether the Council might think the present a good opportunity to appoint another committee to inquire not only into gutta-percha, but into submarine telegraphy generally, he could not say, but the recommendation of Sir Edward Belcher would be laid before the Council, and would have their best consideration. His present duty was to propose a vote of thanks to Mr. Webster, not only for his paper, but also for the kind manner in which he had stepped in to introduce the discussion this evening. He had had the good fortune to bring them to this point—that whereas, on the last occasion they mainly discussed the channel of communication, they had this evening discussed the mode of the communication. The question now arose as to what was the proper quantity of insulating material to use, and what was the best material for that purpose; and when they had settled that question they had to decide which was the cheapest and best mode of laying down the cable. These were difficulties which no one could doubt the energy and enterprise of this country would overcome, because, in the words of their late Royal President, if a body of Englishmen said they would succeed, their energy and indomitable courage never failed in accomplishing success. They might, therefore, hope in a short time to enjoy the great blessing of telegraphic communication with their trans-Atlantic brethren as quickly as they could now do with their friends all over England and on the continent of Europe.

The vote of thanks having been passed,

Mr. WEBSTER said it gave him great pleasure if he had been of service in bringing before them an object of national importance, as he considered this to be. Having on a previous occasion taken upon himself to suggest the resumption of the subject, he would add one word with reference to the proposition of Sir Edward Belcher and the observations of the chairman upon it. It was clear that the matter of the Atlantic Telegraph was now reduced to comparatively narrow limits, consisting merely in matters of detail, and he could not conceive that this society could do itself greater credit than in giving the use of their rooms for the discussion of this subject.

The Secretary announced that on Wednesday evening next, the 18th February, a paper by Mr. A. Nesbitt Shaw, “On the best means for Promoting the Growth and Improving the Quality of Cotton in India,” would be read.

The following communication has been received by the Secretary since the meeting:—

SIR,—I was too sensible of the courtesy of the Council of the Society of Arts, in allowing me to be present and

take a part in their discussion, to encroach upon their time by prolonging my observations last night; otherwise there were two topics upon which I should have wished to add only a few sentences. First, with regard to the route for an Atlantic cable, and, secondly, on the subject of the surveys already made of the bottom of that ocean.

With respect to the first of these points, however, my object would not have been to depreciate the efforts of others in any direction, but to justify our company in their deliberate adhesion to their original line from Ireland to Newfoundland, from a conviction, founded on careful and wide inquiry, that it is the best if not the only certainly practicable line, as well as the one of which (subject to certain conditions on success, to which they have been justly subjected by the government for the protection of the public) they are in exclusive possession against all the world. Their line has been proved by experiment to be practicable, and we think it wise not to depart from this already trodden track, though modifications at the termini and landing-places may probably be admitted.

With respect to the surveys, it appears to have been forgotten or ignored, in former discussions, that two fresh and careful surveys were made, at my request, in the course of last summer, on each side of the Atlantic, by soundings at short intervals, for several hundred miles seaward from each coast, by officers and ships of her Majesty's navy, and with the happy results of proving that the descent into great depths, on the Irish side, is not by a “precipice,” as some have conjectured, but by an easy and gradual incline; that the bottom is not rocky or infested by insects, but tranquil and undisturbed by currents, and consisting of “ooze” and soft and favourable material, calculated to protect rather than injure a cable lying upon or imbedded in it.

There may be points of rock undiscovered “no bigger than the President's chair,” as suggested on one occasion, but the gravel bottom in the great depths has been ascertained to be, if not an absolute “plateau,” as supposed by Maury, at least of a generally equable and plain surface.

I am, &c.,

J. STUART WORTLEY.

Feb. 12, 1863.

AWARDS OF MERIT AT INTERNATIONAL EXHIBITIONS.

(Continued from page 196.)

In August last the Council of the Society of Arts issued a letter, inviting the opinion of the Jurors, the Commissioners for the Colonies and for Foreign countries, and the principal Exhibitors at the International Exhibition, on the question of Awards of Merit in connection with International Exhibitions; and requesting replies to the questions given below, with the intention of embodying the answers in a public report.

AWARDS OF JURIES.

- 1.—Are you of opinion that Awards for Merit, by medals or otherwise, in International Exhibitions, are desirable?
- 2.—State the reasons for your opinion.
- 3.—Ought Works of Fine Art and Designs to be excluded from the awards?
- 4.—Can you suggest any better method than the appointment of jurors for making the awards?
- 5.—Can you suggest any improvement in the constitution or proceedings of the juries?

6.—Is any appeal from the decision of the juries desirable?

7.—If you think awards undesirable, can you suggest any other means by which meritorious productions may be brought to the notice of the public?

8.—Have you any further suggestions to offer on the subject?

The following is a summary of the replies received. The figures attached to the replies correspond with those of the questions:—

JAMES PULHAM, Exhibitor, Class Xc.—1. Yes; if objects are well examined by competent persons and sufficient time is given to compare the various works, there should be awards by juries of gentlemen well known for their judgment or refined taste, not manufacturers or tradesmen. 2. With an award in proportion to the merit, the exhibitor is more likely to become known, and the public benefited, than if left to the uncertain judgment of the press, who sometimes exaggerate their statements, though this originates with the exhibitor. In some things the public may judge for themselves, but are likely to be influenced by puffing advertisements of men of capital, while the more quiet man is unknown, especially so as cheapness is the order of the day, regardless of the quality. Necessary, too, for the quality of some things to be tested, by competent persons, which the public cannot do to advantage, hence the necessity of an impartial award. 3. No; for similar and further reasons, viz., the public are not sufficiently educated in art to distinguish and appreciate deserving works. 4. No. 5. Yes. Suggests that those chosen for jurors, and accepting the duties, should devote sufficient time, and not work hastily, and omit scattered objects. Jurors should be well known for their judgment and refined taste, not manufacturers. 6. Appeal is necessary as omissions and mistakes will happen. 8. There should be no duplicates exhibited, nor should merchants and dealers exhibit the same kind of objects as the manufacturers, as it is taking up room to the exclusion of deserving works, increasing the expense, and making persons of understanding annoyed to find it so shop-like. It has been proved to be necessary, both in 1851 and 1862, to exclude some of the very inferior works sent by persons knowing no better. All works should be remarkable for some peculiarity, or perfection, utility, and good taste, and this might be understood as one mark of honour to be accepted equal to honourable mention. If there are medals there should be two distinctions, but awards on parchment are sufficient, stating the degree of excellence of the principal objects of each exhibitor. To those who are not rewarded, a statement of objections should be made, that they may see they are not unintentionally wronged or omitted. He will not be so uncharitable as to think any wilful neglect or wrong will or has taken place.

SAMUEL SUGDEN (Messrs. Sugden, Son, and Nephew), Exhibitor, Class XXVb.—1. No. 2. Because in some instances merit is so equal that the most meritorious may not always be rewarded, in consequence of trade prejudice with the jurors, it being almost impossible to constitute a satisfactory jury, divided into sections of classes composed of four or five jurors, who have four or five various kinds of goods to judge; the decision will sometimes rest with only one of them, the remainder having but little knowledge, or being quite ignorant, of the subject. 3. No. 4. No. 5. No. 6. Yes; but only in case of deception or fraud by exhibitors. For instance, if British exhibitors, who did not excel in the manufacture of their articles, went to foreign countries to provide themselves with superior goods, and exhibited them as their own and as British manufacture, it is a fraud on their part; and whether the discovery is made before or after the awards are given by the jury (if proved), it should disqualify them from receiving any award for merit. 7. Do away with medals, and grant an award of honourable mention to all cases of merit, omitting only bad and indifferent.

JOHN SUTHERLAND, M.D., President of Class Xb.—

1. Awards for merit necessary. 2. If no authorised awards there would still be awards of some kind, in the way of notices through the press, the authors of which, however honest in intention, might have neither the requisite knowledge nor experience to guide them. Public awards are very highly prized in foreign countries, and it is doubtful if the same amount of interest would be taken in international exhibitions, if no other result than the exhibitor sending his objects, putting his name on them, and taking them away. Public rewards are an acknowledged form of recompense all over Europe, and even learned societies not above their influence. There is therefore custom in their favour. 3. Works of fine art and designs of all kinds should be excluded from awards, or rather should not be included for awards. True works of art are above all competition. They ought to be in advance of all popular taste; they should lead it, model it, and educate it. They require no one to point out their excellence, not even critics. Their influence is peculiar. Besides, the true artist is above all desire of reward, from the mere fact of his being a true artist. As to designs, they should be excluded, because exhibitions should encourage only tangible results, not proposals on paper. There would be endless inconveniences in making awards for the design, unless the design were embodied in a finished work. For example, if a silversmith produced a sculptured vase worthy of award, there should be an award for the designer also, and so of other products. 4. No way in which awards could be so satisfactorily made as by competent juries. But the appointment of competent juries infers necessarily that the objects submitted to them are within their competence; in other words, that there should be a proper classification of objects. On this point the present Exhibition is defective. Considers a proper classification, to enable the right men and the right objects to be brought together, as the very central point of all such exhibitions. Again, there are numerous objects in the present Exhibition which have been adjudicated on without the chance even of the juries arriving at a true knowledge of their merits, and yet the necessity of obtaining such knowledge is admitted in other cases. For example, wines and articles of food, have been tried and adjudicated on after trial. Machines are examined while in action, musical instruments are tried; but as soon as we arrive at domestic appliances for warming or cooking, there is no longer a trial. Juries have nothing to guide them except external appearance, and hence real improvements are overlooked, and awards given in reality merely for the design. In dealing with objects of this kind—and they are very numerous in the Exhibition—a choice might be given to exhibitors to exhibit either with or without trial, but to give special awards only to objects which have been tried. There are many objects of familiar use in which such trial would not be necessary, and in which improvements would speak for themselves, but there are others where trials should be made, and no doubt the different commissions would provide the means of doing so. Our own manufacturers would do this for themselves. 5. Not an easy matter to constitute a jury in all respects satisfactory. Suggests with diffidence that the qualifications required in jurors are common sense, fairness, and competent technical knowledge. Not quite sure that practical acquaintance with the objects as a manufacturer or dealer is an advantage in a juror. Difficult for a man to keep his judgment unbiassed where he has to give an award to anything, however excellent, in his own trade, which he deals in or makes, or especially if he sees that the object is better than his own; and yet the opinion of such a man would be of great service in helping the jury to a fair decision. Feels disposed to select small juries of good and influential names with the qualities required. By having few jurors their individual responsibility is increased, and would select experts to be attached permanently to each class, who should have sufficient knowledge to appreciate the qualities of all the objects in

the class. These experts should be the advisers or witnesses of the jurors, but without a vote. The responsibility of the vote should lie solely with the jurors. On this plan, each class would have its jurors and experts. The experts might be manufacturers, dealers, or any persons practically conversant with the objects. At present, experts can be called in, but this is not enough, they should be permanently attached to the classes.

6. With such an arrangement there would be little need of appeal from decisions of prizes, but perfect fairness to exhibitors requires that there should be an appeal. It could be done as follows:—On a certain day, after the opening of the Exhibition, the awards for each class should be printed separately, and circulated among all the exhibitors of the class, and a certain day should be fixed, before which appeals should be sent in to the Council of Chairmen. These appeals should be on three points. 1st. Absence of notice of an object. 2nd. The award being on a lower scale than the exhibitor anticipated. 3rd. The reasons of the award not being satisfactory to the exhibitor (some important points of his invention overlooked). The Council of Chairmen could dispose of many of the appeals at once, but in cases of doubt, the jury which made the award should be required to state its reasons:—*a*. Why an invention was not noticed? *b*. Why a higher award was not given? *c*. Why the points raised by the inventor as to the reasons of the award are not worthy of attention? (Or else the jury should declare itself further enlightened, and amend the award). The decision should then be given by the Council of Chairmen, and should be either affirmative or negative simply. 7. The present system of recompenses is not all that is desirable. What one longs to see is a better acknowledgment of the "workman" in these awards. One would like to know who the Titans were who made those great marine engines; or whose fingers pencilled the exquisite porcelain paintings which are among the glories of the Exhibition. There must have been designers and chasers, or rather, sculptors of great merit, of all that jewellery and silver modelling which everybody so admires. Some of it is stamped with the very highest marks of art, and yet there is recompense only to the man who pays wages. One would wish to see a more direct connection between the workman who has this exquisite artistic gift and the public which admires it than merely money wages. In the present Exhibition the patentee and the master manufacturer have put their claim successfully forward as against the seller, and justly; but the designer and workman have, to say the least of it, as high a claim to public acknowledgment as either. Would encourage the payer of wages, whose enterprise calls forth so much excellence, as at present, for he fully deserves it, but would try to call forth and encourage all the genius and all the power which lies beneath. It would benefit all parties to do so. The difficulty is how to do it. The first award would be made to the exhibitor, but, in doing this, he might be required to give such particulars in regard to the design and execution to the jury, on their demand, as would enable them to reward the working element. The exhibitor would become an expert to this extent. The mere honourable mention of names of successful workmen would have great effect with the working classes, for it would bring merit of this kind prominently forward, and enhance its value; and to this might be added, in special cases, a medal or other award, which might descend as an heirloom in the family. 8. If it were practicable, should feel disposed to go even further, and to give one special distinction in each class to that exhibitor who, all things considered, was the best in the class—a sort of European industrial distinction, similar to the grant of the Legion of Honour which is given in France for similar purposes. The experience of the present Exhibition appears to indicate that some permanent place of exhibition and sale, where the public might see all that is good in the manufacture of foreign countries and of our own, and might effect purchases on the spot, would be a great additional spur to improvement.

THE ROYAL SWEDISH CENTRAL COMMITTEE for the International Exhibition of 1862, in a report signed by W. Troilus, Vice-President; K. Styffe, Juror, Class I.; Carl Palmstedt, Juror, Class XXI.; Carl Heine-mann; J. Danefelt, Juror, Class IX.; J. Bolinder, and E. A. Höckert, says that having had laid before it by the Swedish Commissioner in London, the questions proposed in reference to the advisability of distributing medals and other distinctions in connection with future international exhibitions, it submits, in reply, the following proposals:—1. The Royal Committee considers that medals and other distinctions, in connection with international exhibitions, are adapted to promote the desired result. 2. The Royal Committee bases the above opinion chiefly on the fact that the direct pecuniary advantages that may possibly be gained by manufacturers from participation, often at great cost, in international exhibitions, usually only fall to the lot of the minority of the exhibitors; that such advantages are mostly attained first after examination and approbation, by qualified persons, of the value and superiority of the articles exhibited, and, consequently, that the mere exhibition, or the anticipated possible sale of the goods of each separate exhibitor, is not a sufficient incentive to the private manufacturer to make those sacrifices of time, labour, and money, necessarily connected with participation in international exhibitions in far distant places, unless, in addition to the purely material advantages, attention be also paid to the praiseworthy desire of each individual to gain distinction and honour both for himself and his country, through the public recognition of the value of his exhibited articles by qualified and impartial men. It appears, also, to the Royal Committee, beyond all doubt, that many exhibitors would not come forward, if the personal distinction conferred by the granting of a medal were withheld. Experience, too, proves the value which manufacturers attach to a medal in the zeal with which this distinction is sought for and employed as a means of recommendation. 3. The Royal Committee considers that distinctions should also be conferred for articles belonging to the fine arts, when the international exhibition of such articles is connected with the exhibition of works of industry; and that such distinctions, as well as those for works of industry, should comprise several degrees, denoting several degrees of merit in different works of art. This opinion is based on the fact that the artist, as well as the manufacturer, needs to be advantageously known and employed as a superior producer, for which reason he, too, to a certain extent, should be measured by the same gauge. It is doubtless true that the artist has in addition to the above motive a purely ideal aim, that does not generally, at least in the same degree, inspire the manufacturer, namely, the honour of a renowned artistic name, often striven for with the greatest self-denial, and the most persevering labour. It is natural that this honour should seek confirmation by a pledge of recognition striven for and won in a competition with the artists of the whole world at a general exhibition, and conferred by judges of art from the most cultivated countries, in the presence of the representatives of all the people of the earth. Such a recognition is not only a powerful incentive to him on whom it is bestowed to continued exertions in order to hold and improve the honourable position attained, but it is also a noble goal towards which those may look who, with young and vigorous energies, enter the often thorny paths of art, and which, whether more nearly or more distantly approached, will encourage many a hopeful and enliven many a sinking heart. 4. The Royal Committee cannot propose any better means for the adjudication of articles exhibited, and the awarding of distinctions, than juries composed of qualified persons from all the countries that have contributed to the exhibition. 5. The Royal Committee considers that the following modifications in the rules adopted at the exhibition of this year, for the construction of juries and the division of their labours, would produce

important advantages:—*a.* That the Commissioners of the country in which the exhibition is held determine the division of the exhibited articles into classes and sections; the number of the international juries according to that division; and the manner in which the members of the juries shall be elected; and, also, announce the time at which such juries shall commence their labours; but that they leave the election of the chairmen and vice-chairmen to the jurors themselves, to be decided at the first meeting of each jury. That the chairmen, vice-chairmen, and secretaries of the several juries form a separate board, to which a special secretary-general be appointed by the Commissioners above mentioned. *b.* That the Commissioners appoint a paid secretary to each class and section. That it be the duty of such secretary, immediately after the opening of the exhibition, and before the juries be convened, to receive, each for his class or section, from the representatives of the several countries at the exhibition, and from the exhibitors themselves, communications and information in reference to the articles exhibited, and also to keep the minutes of proceedings at the meetings of the juries, and to draw up the final report. *c.* That the juries be not convened before the whole exhibition be completely arranged, and that in determining the time, allowance be made for these countries, which, in consequence of peculiar climate, are prevented, in any year, from having their divisions completely arranged before the middle or the end of May. *d.* That instructions be given that a special catalogue for the exhibition of each country, together with the official catalogue, be, if possible, ready before the juries be convened and commence their adjudication. *e.* That, after the completion of its labours, each jury submit to the board of chairmen a complete list of the prizes proposed for its class, accompanied by a report stating the ground upon which such prizes have been awarded, and a description of the qualities, advantages, and appliances of the exhibited articles so distinguished. The Royal Committee does not consider it advisable, and, at the same time, it is attended with great difficulty, to establish any superior tribunal to which exhibitors might appeal from the award of the juries. 7. The Royal Committee, while, as stated before, it considers a system of prizes to be absolutely necessary in order to induce a more general participation in exhibitions combining all branches of industry, yet believes that a system comprising distinctions of different degrees, denoting the greater or less importance to civilisation of an invention or discovery, an improved method of working, a perfection in quality or appliance, and an increased production of necessities, combined with a reduction in price, to be preferable to that adopted at the international exhibition of the present year, by which only one medal was awarded, and the subsequent distinction of "honourable mention" conferred at the recommendation of the juries. The Royal Committee certainly considers the favourable judgment of an impartial jury on an exhibited article, supported by the motives on which that judgment is based, to be the highest and most valuable distinction, and that no distinction should be granted without the reason for its award being stated and published; but at the same time the Committee believes that such a publication, whether it be by tickets attached to the articles rewarded, or by printed lists, is not sufficient to attract that degree of attention on the part of the public which the exhibitor must desire, but that in addition to this, a tangible sign is requisite, and that for such a purpose medals certainly are best adapted. At the same time, for the reasons already stated, and as the judgment of juries on the merits of articles of different character must always, to a certain extent, follow a graduated scale, it appears desirable that these signs of the distinctions awarded should also consist of several degrees. 8. The Royal Committee here repeats the opinion before expressed with respect to the season of the year at which international exhibitions should, at the latest, be held, with a view to the commencement of the labours of the juries, viz.,

that this, in reference at least to the northern countries, should not be fixed earlier than the beginning of June. At the same time it should be definitely announced that no article will come under the adjudication of the juries that arrives at the exhibition later than the time so determined. The Royal Committee considers it of especial importance that international exhibitions, comprehending all branches of industry, such as the three already held in the years 1851, 1855, and 1862, be not repeated too often, and, by preference, not more frequently than every eighth or tenth year. If they recur at shorter intervals it is to be feared that the great expense connected therewith, both for governments and for private manufacturers, would discourage a numerous and varied participation therein, and, also, that by becoming monotonous they would lose their interest to the public, as the genius and industry of man do not so hastily develop their results, unless in exceptional cases, any very decisive progress in a shorter period can be observed. Under all the circumstances it appears desirable that an arrangement should be made between those countries, adapted by their position and other circumstances for international exhibitions, with regard to the time for the renewal of such exhibitions, and that this time should be announced at least two years previously to the opening of any such exhibition.

Rev. MONTAGUE TAYLOR, Juror, Class XXXIII.—1. Yes. 2. Because awards for merit are encouragements to persons to exhibit. 3. Certainly not. 4. No. 6. No appeal is desirable. The decision of the jurors ought to be final.

JOHN THOMPSON, Exhibitor, Class IV.—1. No. 2. Awards give to successful exhibitors an unfair advantage over others, which in many instances is very unfairly earned. Some parties exhibit goods not of their own manufacture, and have obtained medals, their own goods being much inferior to those exhibited, and thereby the public are imposed upon. 3. Yes; for similar reasons. 4. If awards are given, jurors should be chosen by exhibitors of each class, either by ballot or open voting, or by ballot-papers sent in to the secretary. 5. Juries should not be composed of persons who are in the same business, and competing manufacturers and tradesmen, who are, according to all knowledge of mankind prejudiced persons. Jurors should be men well acquainted with the character of the goods exhibited and with an unblemished reputation. 6. Not if jurors were appointed by the exhibitors. As juries were appointed at the present exhibition there should be an appeal. 7. Exhibitors can always bring before the public in the fullest manner anything that merits special notice.

E. TIDEMANN, Commissioner for Norway.—1. Yes. 2. Because it is the only inducement for the industrial class to send their productions for exhibition. This is particularly the case in Norway, where it is very difficult to induce people to manufacture for exhibitions, and should this sort of encouragement be abolished, is afraid the difficulty would be still greater, and believes the same argument applies to other countries. 3. No, for the same reason. Artists is general are very little disposed to lend their pictures for a period of eight or nine months, and have also little chance of selling them in foreign countries, so, taking into consideration the many risks and dangers of damage that are incurred by transport, it is evident that to cease giving awards of merit would be greatly adding to the disinclination of artists to contribute to International Exhibitions. It is difficult to judge works of art, but the reasons given above must be taken into consideration. There was very little inclination at Düsseldorf to take part in this exhibition, and for this reason the school was not so well represented as it might have been. There ought to be several degrees of awards for arts as well as for manufactures. The present system of having only two degrees of award (medal and honourable mention) has been the cause of a vast amount of inconsistency and dis-

satisfaction; the productions of very ordinary silversmiths received the same mark of merit as works of the highest art from such firms as Hunt, Elkington, Christoffe, Vollgold, &c. The adopting an absolute standard as a general basis for decision has certainly its difficulties, more especially when small States are brought into competition, for the rigid adoption of this principle would tend to exclude them; notwithstanding this, an absolute standard in some cases can be the only just one. An intelligent jury should have the opportunity of acknowledging the endeavours of smaller States at exhibitions, even if they did not succeed in reaching the highest standard of merit. The absolute standard would be more practical with large and more cultivated States, which are nearly all upon the same level, but where States of less importance are brought into competition, the modified principle would be more advisable. As the writer has never been on a jury, he can hardly consider himself competent to offer an opinion upon these matters, so possibly his remarks may be incorrect. 4. If prizes are necessary, there must be some sort of organisation through which they should be adjudged and awarded. Juries are therefore necessary. 5. The jury should act in a different manner to that which has been done in the present instance, and they should not begin their labours too soon; this time they commenced long before the various classes were thoroughly complete; they ought also to seek the assistance of the Commissioners who have had all the arrangements. No visit ought to be undertaken by the jury until everything is in its proper place. The jury ought to give a day's notice before making their inspection, and to be punctual at their appointed meetings; this time it was frequently the case that juries who had signified their intention to come did not, and, *vice versa*, juries suddenly came without giving the slightest intimation; consequently, he was not prepared to receive them, and his exhibitors were placed at a disadvantage. There ought to be a longer period granted to the juries to make their visits; seven or eight weeks in an exhibition like the past one is not sufficient. In the Paris Exhibition of 1855, they required the whole period the Exhibition was open to bring their labours to a satisfactory end. 6. Yes, a higher authority to appeal from the decision of the jury is certainly necessary.

C. F. WAERN, Commissioner for Sweden.—1. Yes. 2. The parties interested in the distribution of prizes are the promoters and commissioners of the International Exhibitions, the Governments or authorities appointing juries, the jurymen, the exhibitors, and the public. As the first two classes may be presumed to consider all public benefit gained by the distribution of prizes as remunerating the trouble and expense, the question of public benefits may be proper to be specially considered, as it affects each of the three last-mentioned classes. *a.* Jurymen.—Persons, from their scientific acquirements and positions, suited to become jurymen, may be in a position to visit an International Exhibition at their own expense, or to have claims on their respective Governments, or on scientific or industrial associations, to be sent over at the expense of such bodies; and juries, for the distribution of prizes, will practically tend to increase the number of persons visiting the Exhibitions, thereby deriving advantages to themselves, their countries, and the world in general, a result which must follow from a greater and a more general and more detailed knowledge by such persons of the state and progress of industry, &c. Such persons derive great advantages from the intercourse with other scientific and talented men, the communication of knowledge, and the exchange of ideas with them to which the common determination of awards will lead. They may certainly find and speak to each other at Exhibitions without being jurymen, but, practically, the advantages mentioned will, in that case, either not be gained at all or in an inferior degree, and at best at an enormous loss of time for introductions, exchange of civilities, appointments and agreements, to gain that which the institution of juries and determination of awards procures by itself, viz., united

labour. Lastly, nothing can so sharpen the wits of such persons, increase their energy, and induce the labour required of them for the thorough examination of articles, as the feeling of responsibility of being jurymen, and the ambition of gaining the esteem and good-will of their peers, with whom they are engaged. Considers, therefore, as advantages of the distribution of prizes, and consequent institution of juries, any system which adds to the number of scientific and talented persons visiting and profiting by the Exhibitions; it increases their means of acquiring knowledge, and it obliges them to exertion. *b.* As regards exhibitors.—The exhibitors are benefited by the exertions to which the competition leads them, by the opportunities the visits of the juries afford them of displaying their articles before persons competent to judge of their quality, and hearing the opinions of such persons, and by the increased sales of articles for which prizes have been awarded. Of the benefits from competition in general, unnecessary to say anything. The advantages to exhibitors afforded by hearing the opinions of competent persons must not be overlooked. No doubt it is not the business of the juries directly to instruct exhibitors, nor will time permit its being done, but a remark or suggestion may sometimes prove most valuable; it may often be of the greatest importance to an exhibitor to know why his articles are not so highly valued as those of his competitors, and when it appears as if a little thing were wanting to bring an article to perfection, the interest created may lead to advice and assistance. Competent persons no doubt look at exhibited articles, and speak to exhibitors, without being jurymen, but the strict examination necessary for the distribution of prizes, and the opportunity of speaking to the jurymen, which that examination affords, must prove beneficial. Foremost among the advantages is, of course, the increase of sales of the articles. For some staple branches this has been denied, and even great harm done by the prejudice created through mistakes of the juries. Admitted that many industries are of such a nature that the quality of the articles produced by them must be tried by actual use, and cannot well be judged by samples. In such cases juries must either give no prizes at all (as was very properly resolved upon at the present exhibition, with regard to artificial manures), or they must found their awards on general knowledge, independent of the articles exhibited, in which case their awards only stating generally known facts, must be considered as of little value. It is also evident that as no human judgment is infallible, some amount of unjust prejudice will be created by the awards. But it appears that as regards the former objection it only applies to some few branches of industry, and does not affect the great majority of cases, and that as regards the latter objection, first of all the number of such cases must be very small in proportion to those where the awards are just and well merited; secondly, that number may be diminished by the exhibitors themselves not only making good articles, but also taking care to make the good qualities of their articles evident, by accompanying them with good descriptions; thirdly, the exhibitors are not altogether without a remedy, as they may appeal to public opinion through the public press; and, lastly, the harm done will be less, as the public will learn correctly to estimate the nature of the awards, which are not to be absolute proof of comparative excellence, but good indications thereof. *c.* As regards the public.—The advantage of obtaining good information as to the value of articles being mutual, or even greater to purchasers than to sellers, and, therefore, in stating the advantage to the exhibitors, has stated it as regards the public. The public does not consist of purchasers only, it also comprises statesmen, heads or members of associations for the promotion of knowledge or education, teachers of industrial schools, and other persons, who may have it more or less in their power to influence the march of industry in their respective countries. To these men the awards of the juries and their reports greatly facilitate an

insight into the comparative development of trade and industry in different countries. None or few prizes to exhibitors of some class from a country, clearly show a deficiency in the manufacturers of the country, and a great number of medals to exhibitors in the same class from another country, shows where the knowledge or talent wanted may be obtained. Without distribution of prizes there can be no jury, and without juries no juries' report, and that document forms a most valuable addition to the public knowledge of an exhibition, and remains when the exhibition is past as the most reliable information of the state of industry at the period when it was held. Many books will be written of every description, from which books many things may be learnt, but none can be so valuable, nor so reliable for comprehensiveness, exactness, and impartiality, as the work that forms the joint results of the full and patient investigations of so many and so talented visitors as the jurymen acting under so great a sense of moral responsibility.

4. No. 5. As regards the organisation of the juries has nothing to suggest, but as regards their manner of proceeding makes the following remarks:—The beginning or even the middle of June is decidedly too early for the commencement of the inspections of the juries at an Exhibition opening the 1st of May. From the northern countries the articles cannot arrive before June, and have then to be unpacked and arranged, catalogues to be altered and completed, memorandums to be translated, &c., before they are ready to be inspected. Nor is this only the case with northern countries. When, at the recent visits of juries, the writer was under the necessity of asking them to defer their inspection of his department, heard constantly the presidents or chairmen of the juries proposing a visit to some other more southern country (sometimes one, sometimes another), with the remark, "They are just as bad as you are—not ready yet." Believes it would be well if the juries did not meet for the inspection till at least two months after the opening of an Exhibition, but their time ought by no means to pass unprofitably for their work. The jurymen of the country in which the Exhibition is held should have meetings very soon after the opening, and elect secretaries, who, under the guidance of the Special Commissioner for the jury department, should form catalogues, and collect all memorandums from commissioners and other information, which past experience shows that juries will want. Catalogues cannot be got ready till the opening of an Exhibition, except they are prepared months beforehand, but many exhibitors will then advise articles that they do not afterwards send, and others will send articles not beforehand advised, of such excellence that permission for their being exhibited will not be refused. Catalogues published for the opening will, therefore, always be incorrect; but it is necessary that the juries have correct lists of what they are to inspect, and the preparation of such lists beforehand will greatly facilitate the work of the juries and prevent mistakes, otherwise unavoidable. Further, the writer received, during the time of the visits of the juries, numerous printed circulars, with questions to be answered by him, or by exhibitors in his department. To all those questions he should have been glad to give or procure replies containing full information, but in many instances it was altogether impossible from the shortness of the time within which those replies were necessarily expected. These questions were not founded on any previous inspection of the articles by the juries. They were general, and could as well have been issued weeks beforehand, if the juries had had some preliminary meeting then for the purpose, or secretaries had been elected for each Class, with orders to procure the information wanted. Even if such an arrangement should be impracticable, still a later inspection of the juries would prove beneficial, in enabling the foreign commissioners to complete their catalogues, and provide all the information they are able to judge may be wanted. True, that such information may be collected even before the opening of the Exhibition, but for rea-

sons already mentioned, it cannot then be fully adequate to the purpose, or comprise all the articles sent as it ought to do. Besides, the advantages of fuller knowledge being gained, and many mistakes prevented, the inspections of the juries may, when once they begin, through this arrangement, go quicker, and the jurymen will be able to attend them better, and at less inconvenience or expense. It is my conviction that the final awards may then be made at a very little later time than was the case this year. Full time ought, however, to be given for the correction of the awards of the juries before they are published. The secretaries of the juries ought for this purpose to communicate with the Commissioners for the different classes, countries, and colonies. It will certainly be both better, more agreeable, and really a gain of time, if the lists of awards are first corrected and then published, instead of, as now was the case, first published and then immediately afterwards corrected.

6. No. The whole work of the juries, and the awards themselves, would be a mockery if they were not final, and the moral sense of responsibility of jurymen would be lessened if they knew that appeals might be made, and would be judged by other persons. Has thought of the possibility of allowing dissatisfied exhibitors to remonstrate to the Council of Chairmen, and of that Council having the power to order that such remonstrances, as they consider deserving thereof, to be printed with the reports of the juries, together with such explanations as the secretaries of the juries might be desirous of giving. But considering how odious this arrangement might prove to the juries and their secretaries, what a mass of remonstrances would thereby be invited, and what amount of trouble and work it would cause the Council of Chairmen, is inclined to think such an arrangement impracticable, and the benefits to be gained thereby not worth the inconveniences.

7. Approves of the present system.

8. Considers the time for the meetings of the juries to inspect articles should be taken later after the opening than was the case this year. See reply to question 5.

(To be continued).

OBITUARY NOTICE OF JOSEPH GLYNN, F.R.S.

The subject of this memoir was a native of the North of England, which has produced so many men eminent in mechanical and engineering pursuits. He was the son of Mr. James Glynn, of the Ouseburn Iron Foundry, Newcastle-upon-Tyne, and was born in Hanover-square, in that town, on the 6th of February, 1799. The same master who taught the rudiments of mathematics to Robert Stephenson, Mr. John Brace, of the Percy-street Academy (himself a mathematician of considerable attainments), who turned out many pupils attaining eminence in various walks of life, assisted in the intellectual training which enabled Mr. Glynn to apply to useful purposes the mechanical endowments with which he had been gifted, and which seem to be born with their possessor rather than acquired by after education. He continued at the Ouseburn Iron Foundry as his father's assistant till the year 1820, when he executed his first engineering work, which was the erecting of a steam-engine for the Earl of Carlisle, to drain the Talkin Colliery, near Brampton, Cumberland. He was assisted in the execution of the work by two young mechanics, then workmen, who have both attained great eminence in their several walks, Sr Peter Fairbairn and Mr. Robert Hawthorn. In the following year, 1821, the introduction of coal gas having rendered the inhabitants of Berwick-upon-Tweed discontented with the old lights, he was called in to design and execute the gas-works of that place. The success of these gas-works was so complete, that he was applied to by the inhabitants of Aberdeen to design gas-works for that city, and he furnished reports and plans, though his other engagements prevented him from superintending their execution, being engaged by the Butterley Iron Company, in the county of Derby, as their engineer.

From this time Mr. Glynn's individual reputation became almost merged in that of this Company, with which for more than a quarter of a century his name was associated. Stationary engines of small power were employed in those days in drawing to the surface of the earth its buried treasures; but he gradually increased their power until it reached two hundred horses. The locomotive was struggling into being through the efforts of Trevithick and Brunton, and in the brain of George Stephenson. In his visits to Killingworth with his schoolfellow, Robert Stephenson, young Glynn "sat at the feet of Gamaliel," and the seed sown in these interviews afterwards ripened into works of solid practical utility. The Butterley Company undertook and executed works of whose merit it will never be known how much was due to their engineer, and how much to them as contractors. The great engineers of that day found useful auxiliaries, and a formidable arsenal, in the extensive resources of the Butterley Iron Works. Sir John Rennie was at that time employed by the Government to complete the Royal Naval establishment at Sheerness, and Sir Edward Banks undertook the works as contractor for a sum of nearly one million sterling. A great part of the iron work for this extensive contract was executed at Butterley. The same engineer and contractor undertook the building of the new London Bridge, probably the most beautiful work of the kind ever executed in any age or country, and the steam machinery for keeping out the water while the works proceeded was supplied from the same source which had already furnished the ironwork of Vauxhall-bridge, erected from the designs of Mr. James Walker. Mr. Miller, afterwards senior of the well-known firm of Miller, Ravenhill, and Salkeld, who was Mr. Glynn's predecessor at Butterley, had previously begun the engines of the *Lord Melville* for the General Steam Navigation Company; these were completed by Mr. Glynn, and were followed by the *Earl of Liverpool*, the *Attwood*, the *Sir Edward Banks*, the *City of London*, *Royal Sovereign*, *Brocklebank*, and *Ramona*, for all of which the engines were designed by Mr. Glynn. The Gainsborough and Hull packet, and the *Trent*, plying on the Humber, were also the precursors of a system of river navigation by steam for the conveyance of merchandise, which the *Rob Roy*, with engines designed by him, carried to Hamburg.

The engineering skill of Mr. Glynn was also called in from time to time to repair and reconstruct several steam vessels built elsewhere. The *Victoria*, of which the boilers twice exploded, was made a trustworthy and seaworthy vessel by his alterations. The *Harlequin*, *Columbine*, *Superb*, *Hylton Jolliffe*, *Rapid*, *Talbot*, *Belfast*, *William Jolliffe*, and *Mountaineer*, all passed under his hands, and were altered and made effective by the Butterley Company. The *Firefly* and *Firebrand* for the English navy, and the *Jason* and the *Colehis* for the Russian government, were fitted with engines from his designs, as were the *Nicholas I.* and the *Alexandra*, the first steamers from Lubeck to St. Petersburg under the Russian flag. The Butterley Company also fitted out steam dredging vessels for the state of Lubeck, for the Hanoverian government, and others. The iron roofs, mills, and heavy machinery which were executed from Mr. Glynn's designs, and which were despatched from Butterley to all parts of Europe, to the Colonies, the East and West Indies, and the continent of America, bore testimony to his industry as well as to the fertility of his invention, though these modest labours seldom came before the world. The number of powerful steam engines executed at Butterley for mining purposes was very considerable, both in pumping and winding engines, one of which was erected at Leasingthorne Colliery, near Ferry-hill, for the Durham County Coal Company. Mr. Glynn had a high opinion of water as a motive power, and executed some water wheels of large dimensions. His name, however, will be chiefly associated with the employment of the water wheel, or scoop-wheel as it is called, in draining marshes and fens by steam power. A

water wheel driven the reverse way by a steam engine where the object is to lift a large quantity a short distance, has been found greatly superior to any system of pumps, and this plan was used by Mr. Glynn with great success in the fen country in England, and also in Hanover, and Holland, a "polder," near Rotterdam, having been thus drained. He was in correspondence with his late Majesty the King of the Netherlands concerning the application of this system to the Lake of Haarlem, when the abdication of his Majesty transferred the execution of the project to other hands, and it has since been successfully carried into effect by pumping engines. He also drained by steam power the following districts, amounting to many thousand acres:—Deeping fen, near Spalding, Lincolnshire; Misterton Soss, with Everton and Grindley Carrs; Littleport fen, near Ely, Cambridgeshire; Magdalen fen, near Lynn, Norfolk; Middle Soham fen, Cambridgeshire; Soham Mere, Cambridgeshire; Sutton and Mepal, near Lynn, Norfolk, altered by him in 1861; Waterbeach level, Cambridgeshire; March district, March West fen, Cambridgeshire; the Binnimoor district, Mildenhall, Suffolk; and Lakenheath, Suffolk, for which the Butterley Company manufactured the engines from his drawings; also for the Hammer-brook drainage, near Hamburg, of which Mr. Lindley was the engineer under the Hamburg government. He also executed some drainage works by steam power in the Colonies, one of which, fulfilling a double purpose, was erected in British Guiana, drainage in the wet season being combined with irrigation in the dry season. His drainage works in the counties of Cambridge, Norfolk, Suffolk, Lincoln, and York, were extensive and successful. Mr. Glynn also designed and constructed, from his own designs and those of other engineers, many iron bridges, among which may be mentioned the bridge between Doncaster and Selby, a complete and elegant structure, known as Haddelsey bridge. He also constructed, for the Dean and Chapter of Ely Cathedral, an iron bridge at Ely, which, though now eclipsed by the Railway works near it, was at the time much admired. He also built, from designs taken by Mr. Milne from the celebrated bridge at Florence, a bridge across the Cam at Gerard's Hostel, Cambridge; also from Mr. Walker's plans the lifting bridge at Selby, on the line of the Hull and Selby railway.

Mr. Glynn was concerned with Mr. Jessop in setting out the Midland Counties Railway. He was one of the Committee by whom the purchase of the Great North of England Railway was negotiated for the Company now called the North Eastern. He also took an active interest in the affairs of the Midland Railway before mentioned, with the working of which, in the neighbourhood of Derby, he was well acquainted. He was the Secretary of the Committee of Investigation into the affairs of the Eastern Counties Railway; and when, in consequence of their report, Mr. Hudson and Mr. Waddington resigned, Mr. Betts was appointed Chairman, and Mr. Glynn Deputy-Chairman, of that Company. On the retirement of Mr. Betts shortly after from the active duties of the Board, Mr. Glynn filled the office of Chairman for two years.

The Gold Isis Medal of the Society of Arts was voted to Mr. Glynn for a communication dated 8th of February, 1836, on his application of steam power to draining fens. This paper was republished in French, and also was translated into German, and published in Hanover. It was published in Mecklenburg, and was also translated into Dutch, and published in Holland. Descriptions of cranes for the Royal Dockyard at Woolwich were contributed by Mr. Glynn to the professional papers of the corps of Royal Engineers, as well as other useful and valuable writings. The want of similar publications in his youth had made him feel the shortcomings of many scientific works, and his object in writing was rather to produce a hand-book for the use of the mechanic and the artisan than an elaborate treatise of little practical use. Mr. Glynn contributed several papers to the Transactions of the Institut

tion of Civil Engineers, of which the following excited much public interest. On the 22nd June, 1847, he read before the Institution, and in the presence of the present Emperor of the French, "A Review of the Plans which have been Prepared for Connecting the Atlantic and Pacific Oceans by a Navigable Canal." The Emperor of the French, then Prince Louis Napoleon, having written on the subject, was invited by Sir John Rennie, then President, to take part in the discussion, and spoke at some length. On the 20th of May, 1851, Mr. Glynn read a paper, "On the Isthmus of Suez, and the Canals of Egypt," which drew forth a most interesting disquisition from Mr. Robert Stephenson. Mr. Glynn contributed to Mr. Weale's rudimentary series one of the most popular, "A Treatise on Cranes," of which work 30,000 copies were sold, and which has been translated into nearly every European language. The "Treatise on the Power of Water" has met with nearly equal success, and has put within the reach of the millwright and the mechanical engineer the information which a few years since was confined to the mathematician.

On the 16th November, 1836, he was elected a member of the Society of Arts, and subsequently a Member of the Council and a Vice-President.

On the 8th February, 1838, he was elected a Fellow of the Royal Society. He had been for several years previously a Member of the Institution of Civil Engineers. His first contribution to their archives was a translation of "Perdonnet's Account of the Iron Works of France," which had been previously but little known to Englishmen interested in the trade.

The opinion of Mr. Glynn, as a sound practical man, was much valued by the profession, and his evidence was sought in many cases of disputed patents; his judgment in the arbitration and settlement of disputes where mechanical matters were concerned was highly esteemed. He was examined before the Royal Commissioners on the use of iron in railway structures, and reported on the Overland Route to India, and the competing scheme of the Euphrates Valley, and gave evidence before Committees of the Lords and Commons on various railway and other projects.

He died in London, on the 6th inst., aged 64.

Home Correspondence.

THE SUBMARINE CABLE.

SIR,—I have read, with considerable interest, a paper, by T. A. Masey, upon "The Submarine Telegraph," as published in the *Journal of the Society of Arts*, January 30th.

Although it may appear invidious for a man to speak of his own works, useful and scientific, I feel assured that, as an Englishman, my fellow-countrymen will feel pleased to accord to me, in the national spirit of fair play, the merit which is simply due to my exertions.

Were it not that I have documentary evidence in proof of my assertions, I should feel greater diffidence in making the following remarks:—Should a man succeed in flying through the air from the Crystal Palace to St. Paul's, we should have hosts of parties claiming priority of the idea, despite the numberless records in proof that even the ancients possessed similar aspirations. The merit, nevertheless, of rendering the flight practicable and of interest to the outer world, would rest with the man who first proved, by a shorter flight, that the whole distance could be accomplished.

I claim to have taken the first practical steps towards the accomplishment of the Atlantic telegraph line, by connecting the easternmost point of Newfoundland with the continent of North America, it being self evident that an Atlantic cable could alone render the necessary investment of capital productive, and that only by a clear

demonstration as to its feasibility could such capital have been procured.

Step by step I worked the problem out, making the first survey across Newfoundland in anticipation of the undertaking, and laying the first submarine cable submerged in American waters. To myself, personally, was granted the first exclusive charter for constructing lines across Newfoundland, and I was associated in the second charter, conveying more extended privileges. I then constructed the line, resigning my duties only when the whole route between New York, Canada, and Cape Race was in perfect working order.

It is a matter of history in British America how Mr. Cyrus Field and his friends (who wished to appear before the world as the originators of so great an enterprise) interfered with my rights in connexion with the Atlantic line; and I shall be pleased to show the public documents and extracts from the British and American press, in substantiation of such history.

At present, I confine myself to the following remarks:—That second upon the list of submarine cables, the following entry should, by right, appear:—

"1852. From Prince Edward's Island to New Brunswick, one conductor, No. 16, copper wire gauge. Ten No. 8 galvanized outside wires. Distance, 12 miles. Depth of water, 14 fathoms. Manufactured by R. S. Newall & Co. Imported and laid by F. N. Gisborne. Working 3 years."

The shore end of this cable was injured by ice during the third winter, and was so damaged afterwards by an ignorant repairer (who actually raised the whole of the cable, in lieu of underrunning it), that it was found expedient to replace it by a new cable during 1856.

In conclusion, I would remark that I have seen the gutta serena covering of wire eaten through and through by marine animalculæ, and secondly, from experience, I know that it is a matter of extreme difficulty to manufacture a cable with hemp or any other partially elastic outer covering. Mere specimens of cables are eminently deceptive as to the possibility of producing a similar article in greater lengths.

You are quite at liberty to make such use of this letter as you deem proper, and

I am, &c.,
F. N. GISBORNE.

Proceedings of Institutions.

DROITWICH LITERARY AND MECHANICS' INSTITUTE.—The members of this Institution held their annual *soirée* in the assembly-room at the George Hotel, on Monday evening, 5th January. The room was very handsomely decorated. Over one of the chimney pieces were the initials of Mr. and Lady Georgina Vernon, formed of crystallised salt, which glittered brightly in the light and had a very pretty effect. Mr. H. F. Vernon, M.P., presided, and was supported by Sir J. S. Pakington, Bart., M.P., Mr. P. Amphlett, Rev. W. W. Douglas, Mr. J. S. Pakington, Mr. R. A. D. Gresley, &c. The Institute brass band, led by Mr. Holyoake, performed during the evening, and the vocal arrangements were under the superintendence of Mr. Hunt.—The CHAIRMAN announced the reception of letters from Sir Charles Hastings and Sir E. A. H. Lechmere, Bart., the High Sheriff of the county, regretting their inability to attend the *soirée*. He then proceeded to say, that, seeing the varied and interesting nature of the programme, he should not address the company at any great length, and he was afraid that the few remarks he might make would hardly be considered worthy of the name of an opening address. However, he was sure they would be convinced that the interest he took in the welfare of the Institution was of no superficial kind, and that it was with extreme pleasure he viewed

the praiseworthy exertions made from time to time by their committee.—Sir J. S. PAKINGTON rose to move the first resolution. The Right Hon. Baronet said he obeyed the call of their Chairman with the greatest possible pleasure, and he might add that he always rose with the same feelings to address the annual meetings of the friends of the Mechanics' Institution of Droitwich. The resolution which had been placed in his hands was one which he entirely approved. It was—"That Mechanics' Institutes present to philanthropists many attractive objects: they bring into intimate association the high and the low; and theoretically and practically, and by force of example and judicious foresight, point the way to attaining health of body and vigour of mind." He entirely concurred in the wording of that resolution, and in no part of it did he more agree than in that which stated that institutions of that character brought together the high and the low, and he thought they had a very happy illustration of it in the company which attended their annual meeting that evening, as it showed the beneficial manner in which some sought for recreation and others for instruction. Taking the practical principle, he might say that the trading, the working, and the higher classes, were happily brought together wherever those institutions existed, and in an harmonious manner which was beneficial to all of them. So it was with the theoretical. Institutions of that kind afforded innocent and useful recreation and the means of instruction to those who sought it after that period of life when they ceased to attend school. He was sure he need not dwell upon the latter part of the resolution, wherein it stated that the members of such Institutions attained health of body and vigour of mind. If the advantages of those Institutions were properly recognised and properly used by those who resided within the circle of their influence, then the great object of them was certainly to increase the health of the body and invigorate the mind, and so improve the intellectual by an attainment of that amount of stock knowledge without which we, as a nation, should have been unable to effect that progress which we now saw being made around us. With regard to their particular institution at Droitwich, he trusted that it would increase, and that progressive prosperity would attend it. He was happy to hear that, in a financial point of view, the institution was prosperous, and he trusted it would long continue so.—The resolution was seconded by Mr. P. AMPHLETT.—Mr. J. S. PAKINGTON moved the second resolution, as follows:—"The prosperous financial condition of the Institute is a subject of congratulation, and proves that the resolution passed at the last meeting, showing that the Institute was entitled to the support of all classes, has met with a liberal response."—Mr. J. BLICK, the Mayor of Droitwich, seconded the resolution.—Sir JOHN PAKINGTON bore testimony to the beauty of the decorations, and proposed a vote of thanks to the ladies, which was seconded by Mr. AMPHLETT, and carried with acclamation. Mr. BRADLEY replied on behalf of the ladies, after which a vote to Mr. Vernon, on the motion of Dr. RODEN, seconded by Mr. J. CURTLER, surgeon, was proposed, and to which the CHAIRMAN appropriately replied, proposing in conclusion the thanks of the meeting to the Institute band for their services, which was suitably acknowledged by Mr. HOLYOAKE. After a little more music, the company betook themselves to dancing.

METROPOLITAN ASSOCIATION FOR PROMOTING THE EDUCATION OF ADULTS.—A public meeting was held on Friday, January 30th, at St. Paul's School-room, Southwark, for the purpose of bringing under the notice of the working men in that neighbourhood the plans of the Association. The chair was taken by J. Locke, Esq., M.P. Addresses were given by the Rev. J. Wallis, Hon. Sec., and Mr. H. H. Sales, Secretary, explanatory of the scheme of Examinations conducted by the Society of Arts and the Metropolitan Association. On the motion of Mr. Churchwarden Myers, seconded by Rev. J. Ryland, it was resolved to establish a Local Board for the district.

The Chairman addressed the meeting at some length on the advantages of education, and expressed his approval of the various operations of the Association.

MEETINGS FOR THE ENSUING WEEK.

- MON. ...Medical, 8½. Mr. Thomas Bryant, "On the Differences between the Diseases of the Nervous, Respiratory, Circulatory, Digestive, and Urinogenital Systems of the Child and Adult."
Asiatic, 3.
Royal United Service Inst., 8½. Capt. G. B. V. Arbuckle, "A New System of the Application of Iron to Forts and Ships."
- TUES. ...Civil Engineers, 8. Discussion, "Drainage of Dundee," and "Sewerage of Newport (Mon)."
Statistical, 8. Rev. J. E. T. Rogers, "On the Rationale and Working of the Patent Laws."
Pathological, 8.
Ethnological, 8.
Royal Inst., 3. Prof. Marshall, "On Animal Mechanics."
R. Horticultural, 2. Ballot for Seeds.
- WED. ...Society of Arts, 8. Mr. A. Nesbitt Shaw, "On the Best Means of Promoting the Growth and Improving the Quality of Cotton in India."
Geological, 8.
- THURS. ...Royal, 8½.
Antiquaries, 8½.
Linnæan, 8. 1. Mr. F. Smith, "On the Geographical Distribution of the Aculeate Hymenoptera of the Eastern Archipelago." 2. On the Anatomy of the Guinea Worm (*Fi-laria medinensis*).
Chemical, 8.
Numismatic, 7.
R. Society Club, 6.
Royal Inst., 3. Dr. E. Frankland, "On Chemical Affinity."
- FRI. ...Geological, 1. Annual Meeting.
Philological, 8.
Royal Inst., 8. Mr. G. Williams, "On Jerusalem."
Royal Horticultural, 2. Election of Fellows.
- SAT. ...Royal Inst., 3. Prof. Max Muller, "On the Science of Languages."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[From Gazette, January 30th, 1863.]

161. H. Rushton, Northampton-road, Clerkenwell—Imp. in machinery for plating cotton, thread, or other fibrous material over steels for crinolines, and in the mode of securing the plating to prevent its slipping thereon.
162. R. A. Brooman, 166, Fleet-street—Imp. in the manufacture of sulphate of soda for conversion into soda and other uses. (A com.)
163. W. H. Harrison, Haverfordwest—Imp. in covering wire and other iron articles for the purpose of protecting them from oxidation, and in the mode or method employed therein.
- Dated 20th January, 1863.
167. J. Mosheimer, Dolgelly, Merioneth, Wales—Imp. in machinery for crushing and grinding quartz and other substances.
168. J. Bell and J. Speight, Phoenix Iron Works, Jersey-street, Manchester—Certain imp. in the construction of carding engines.
169. W. Mawson and J. Whitehead, Calverley, near Leeds—Improved hydraulic machinery for raising water in mines, wells, and other places.
170. H. A. Bonneville, 24, Rue de Mont Thabor, Paris—Imp. in the manufacture of clocks. (A com.)
172. M. Henry, 84, Fleet-street—Imp. in apparatus for retarding and stopping railway carriages. (A com.)
175. H. Hughes, Homerton, and J. Sanders, Nottingham—Imp. in machinery and apparatus for the manufacture of trimmings and cap fronts.
176. S. Blackwell, 259, Oxford-street—Imp. in apparatus for applying water or other fluid to the legs and other parts of horses and other animals.

Dated 21st January, 1863.

178. A. Phillips, Glasgow—Imp. in looms for weaving figured fabrics.
180. F. A. Busch, Briton Ferry, South Wales—Imp. in the manufacture of metallic vessels or receptacles for containing liquids or substances.
182. H. B. Barlow, Manchester—Certain imp. in jacquard machines. (A com.)
184. A. Boubee, Paris—Imp. in apparatus for casting or moulding articles in glass, and in imitation of precious stones or marbles.
186. W. Clark, 35, Chancery-lane—Imp. in decalcifying and in preserving matters from decay. (A com.)
190. A. Pennington, 1, Rectory-villas, West Hackney—Imp. in apparatus for beating mats, rugs, and other such like articles.

Dated 22nd January, 1863.

194. W. Harrison, Blackburn, and B. Croasdale, Witton, near Blackburn—Certain imp. in looms for weaving.

196. J. Grant, Albion-place, Maidstone, Kent—Imp. in the construction of sidings and loop lines for railways or tramways, whether portable or otherwise.
200. W. Blackwood and J. Blackwood, Dumbarton, N.B.—Imp. in machinery for drying yarns or threads.
202. N. Wood, Hetton-hall, Durham, and J. Stockley, Newcastle-on-Tyne—Imp. in apparatus for grinding, smoothing, and polishing plate glass.
204. C. Lungley, Deptford, Kent—Imp. in means for facilitating the repairs of ships and other structures.

[From Gazette, February 6th, 1863.]

- Dated 18th October, 1862.
2816. W. E. Gedge, 11, Wellington-street, Strand—Improved apparatus for extracting condensed steam. (A com.)

- Dated 27th November, 1862.
3182. J. L. Linton, Buckingham Palace Hotel, Buckingham-gate—Imp. in the means of generating steam, and in the apparatus to be employed therein. (A com.)

- Dated 9th January, 1863.
76. E. A. Goupil, 10, Rue d'Hauteville, Paris—An improved locomotive apparatus.

- Dated 13th January, 1863.
102. T. Boyle, Gray's-inn-terrace, Gray's inn-lane—A new apparatus for multiplying indefinitely the reflections of all objects that are capable of being viewed in it.

- Dated 15th January, 1863.
131. T. C. Barracough, Manchester—An improved alarum apparatus, which may be employed in connection with locks or other fastenings. (A com.)

132. J. Harrop, Manchester—Imp. in the treatment of organic, fecal, and urinous matters for the purpose of deodorising the same, and in the preparation of a portable manure therefrom, and in the treatment of ashes or other refuse of combustion to be combined therewith, also for imp. in machinery to be employed in the manufacture of the said manure.
134. R. Ferrier, Edinburgh—Imp. in wet gas meters.

- Dated 16th January, 1863.
144. J. Kerr, Manchester—Certain imp. in the means of retarding or stopping railway and other carriages.

- Dated 17th January, 1863.
150. J. Edwards, 29, Basinghall-street—Imp. in the manufacture of buttons.

156. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of buttons. (A com.)

- Dated 19th January, 1863.
158. C. Norton, 47, Hawley-road—A new or improved method of roughing horses.

164. J. J. Lundy, Leith—Imp. in the manufacture of metallic casks and vessels.

- Dated 22nd January, 1863.
198. J. M. Binger, Brussels—An improved paste or composition to cover the rollers used by letter-press printers.

- Dated 23rd January, 1863.
206. J. Milner, 7, Bridge-street, Westminster—Imp. in steam-engines.

208. E. Strangman, Waterford, Ireland—Imp. in pipes for smoking.

212. P. A. Cole, Croydon-street—Imp. in articles of dress known as collars, cuffs, wristbands, shirt fronts, habit shirts, and petticoats.

214. E. T. Hughes, 123, Chancery-lane—Imp. in breech-loading fire arms. (A com.)

- Dated 24th January, 1863.
216. W. Mellor, Ardwick, Manchester, and W. Whaley, Rainow, Cheshire—Imp. in steam hammers and other engines driven by steam.

220. M. A. F. Menmons, 24, Rue de Dunkerque, Paris—Imp. in machinery for punching and cutting metals. (A com.)

222. A. J. Sax, Paris—Imp. in rendering drum skins and gutstrings less liable to hygrometric influences.

224. F. Tolhausen, 17, Rue du Faubourg Montmartre, Paris—Imp. in looms for weaving ribbons. (A com.)

- Dated 27th January, 1863.
236. C. Askew, Charles-street, Hampstead-road—An improved railway chair and joint for rails on railways.

238. R. A. W. Green, Putney, Surrey—Imp. in light rowing boats, usually termed waver boats.

242. W. C. Wilkins, Long-acre—Imp in lamps.

Dated 28th January, 1863.

244. H. Watson, Renton, Dumbarton, N.B.—Imp. in the heating arrangements of stoves for drying woven fabrics.

246. W. E. Gedge, 11, Wellington-street, Strand—Improved machinery or apparatus for fastening by screws boots, shoes, and other articles composed of leather. (A com.)

248. J. Oglesby, J. Dickinson, W. M. Dickinson, and J. Dickinson, junr., York—Imp. in apparatus for steaming, cooking, and generating gas.

250. C. Mace, Sunderland—Imp. in steam engines for propelling vessels and for other purposes.

252. F. W. Wymer, 7, St. Ann's-row, Newcastle-on-Tyne—Imp. in steam engines.

252. W. Conisbee, 39 and 40, Herbert's-buildings, Waterloo-road—Imp. in cylindrical chromo-lithographic printing machines.

256. W. Clark, 53, Chancery-lane—Imp. in means and apparatus for copying and reproducing sculpture and other objects of art. (A com.)

258. C. P. Stewart and J. Robinson, Manchester—Imp. in and applicable to that apparatus known as "Giffard's injector," and in the adaptation of it to locomotive and other boilers.

260. H. Crichley, Birmingham—Imp. in reaping and mowing machines. (A com.)

Dated 29th January, 1863.

266. R. A. Brooman, 166, Fleet-street—Imp. in the manufacture of candles. (A com.)

268. W. Ball and J. Wilkins, Nottingham—Imp. in machinery employed in the manufacture of looped fabrics.

270. N. Clayton and J. Shuttleworth, Stamp End Works, Lincoln—Imp in thrashing machines.

272. A. Pritchard, Derby—An improved method of preserving the contents of packages from air, water, or damp.

274. W. Clark, 53, Chancery-lane—Imp. in the condensation of steam, and in apparatus for the same. (A com.)

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

262. H. A. Bonneville, 24, Rue du Mont Thabor, Paris—Imp. in the construction of granaries. (A com.)—29th January, 1863.

265. J. Mackenzie, Arundel-square, Islington—Imp. in shaping machines for curvilinear surfaces.—29th January, 1863.

PATENTS SEALED.

[From Gazette, February 6th, 1863.]

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| February 6th. | 2257. A. Delrue. |
| 2231. Sir J. S. Lillie. | 2258. C. M. Westmacott. |
| 2233. A. J. Moreau and A. E. Ragon. | 2261. A. B. Childs. |
| 2234. A. J. Moreau and A. E. Ragon. | 2269. J. R. Tussaud and F. C. Tussaud. |
| 2235. T. De la Rue. | 2292. J. Hearn. |
| 2244. J. Lancelott. | 2313. F. Barnett. |
| 2246. W. E. Gedge. | 2375. W. H. Turner. |
| 2249. A. J. Martin, J. Goss, and J. Bush. | 2531. J. Pender. |
| | 2957. G. Haseltine. |

[From Gazette, February 10th, 1863.]

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| February 10th. | 2301. T. Cawin. |
| 2262. C. Sengry. | 2302. T. F. Kirby. |
| 2263. G. Sanders. | 2306. J. H. Johnson. |
| 2271. W. L. Boyle. | 2307. H. Garside. |
| 2273. H. Twelvetees. | 2314. J. Cimeg. |
| 2280. A. Walker. | 2405. E. A. Pontifex. |
| 2281. J. Irvine. | 2410. J. H. Johnson. |
| 2285. W. Beatson. | 2423. J. H. Johnson. |
| 2287. D. P. Marques. | 2366. J. H. Johnson. |
| 2290. W. J. Curtis. | 3115. J. Jewsbury. |
| 2296. W. B. Herapath. | 3311. M. Osborne. |
| 2297. C. E. Spagnoletti. | |

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[From Gazette, February 10th, 1863.]

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| February 2nd. | February 4th. |
| 276. A. Denny and E. M. Denny. | 324. A. L. E. Breitmayer. |
| | 833. G. F. Wilson. |
| 279. L. P. Barre. | February 6th. |
| 286. R. Fielden, jun. and T. Fielden. | 377. A. V. Newton. |
| | February 7th. |
| 288. K. Bodmer. | 335. J. H. Johnson. |
| | 345. J. Langford and C. Chester |

LIST OF DESIGNS OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietor's Name.	Address.
4536	Jan. 27.	Portable Clothes Drier or Bar	Carroll Eugene Gray	73, Great Suffolk-street, Borough.
4537	Feb. 4.	Improved form of Pistol	Thomas Woodward	23, Edward-street, Birmingham.
4538	" 10.	{ Metallic Mounts for Gas or Lamp Re- { fectors	Herbert William Hart	125, Fleet-street, E.C.
4539	" "	{ Improved Ventilator for Dwelling { Houses and other buildings	Jas. A. Forrest and Co.	Lime-street, Liverpool.